

ILLUSTRATED CATALOGUE

AND

PRICE LIST

OF

The Garvin Machine Co.

MANUFACTURERS OF

Machinery & Machinists' Tools,

INCLUDING

Milling Machines, Drill Presses, Screw Machines,
Hand Lathes, Cutter Grinders,
Tapping Machines, etc.

Special Machinery Designed and Constructed.

Gear Cutting and Milling in all its Branches.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

February 1890.

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PREFACE.

The Works of the GARVIN MACHINE COMPANY, New York City, U. S. A.

THE GARVIN MACHINE Co., was incorporated Nov. 13th, 1889, and is the direct successor to the firm of E. E. Garvin & Co., which was established in 1878.

Since the last edition of our Catalogue was published we have removed our works to the building at Lighthouse and Canal Sts., where we occupy seven floors.

The location is especially fine, being near the principal freight depots, and very accessible from any part of the City. The Sixth and Ninth Avenue Elevated Roads are within two blocks of the building. The Sixth, Seventh, Eighth and Ninth Avenue and the Grand and Cortlandt Street surface cross-town cars pass the door or within two blocks. The Broadway cars run within three blocks.

The floor space is about 45000 sq. feet, and the building has light on three sides. The entire building is illuminated by gas and electricity. The basement is occupied by the blacksmith shop, which is supplied with a steam hammer; and the boilers for the 100 Horse Power Engine. The first floor is occupied by the show rooms where we exhibit a large stock of machinery, both new and second hand, and of our own and other makers. The offices and shipping department are also on the store floor. The remainder of the building is occupied entirely by the machinery used in the manufacture of the machines, described and illustrated in the ensuing pages. Our factory is provided with tools carefully graded as to quality, giving us facilities for doing a wide range of

INTRODUCTION.

In presenting this Catalogue to the trade, The Garvin Machine Co. have endeavored to bring out the salient points of their machines, both by copious description and carefully executed wood cuts. Since the last issue of our Catalogue, we have made a number of additions to our line of manufacture: the No. 00 Screw Machine, the No. 3 Screw Machine, with and without wire feed; a full line of Chucking Machines; the two Spindle Profiler, the No. 0 Universal Milling Machine, and others which appear in this Catalogue for the first time. We have added to our styles of Milling Machines so that we now offer to users of machinery a selection of no less than 16 different patterns and sizes of Milling Machines.

Those requiring machines for special manufacturing operations can be accommodated from the numerous special machines built by us. A sample or drawing, with full specifications of results wanted, will enable us to promptly furnish estimate. Our unflinching efforts are directed toward maintaining the highest standard of workmanship and efficiency, and to that end the co-operation of our patrons is earnestly desired. We use no materials but the best, nor do we use the contract system in the manufacture of our tools.

A rigid system of inspection is pursued with parts as well as the whole machine, and where necessary, the machines are subjected to actual operation before leaving the works.

All spindle collars are provided with our standard hardened and ground antifriction washers, and are provided with ample means for taking up wear, and at the same time preserving the accurate alignment. No emery is used in fitting, but all sliding surfaces are scraped to bearing. Our standard machines are built with special tools, thus assuring the purchaser that parts can be re-

be replaced at a moderate cost. Terms: Cash, 30 days to responsible parties, unless otherwise agreed. Prices F. O. B., New York. Boxing for export at cost.

Our unusual shipping facilities give customers the advantage of the best freight rates, and enable us to ship direct to destination with the least possible re-handling.

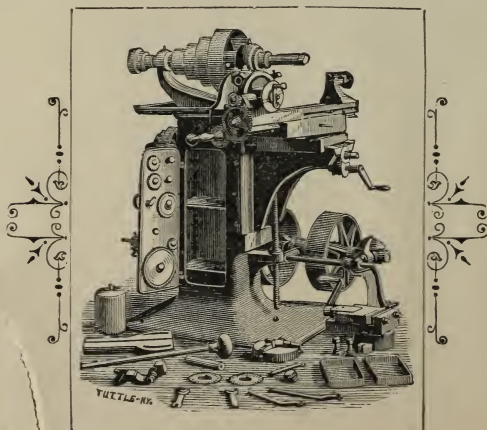
We solicit correspondence in regard to articles of our manufacture, and shall endeavor to meet the most exacting requirements of first class work. Photographs of special machines and those not illustrated in the following pages, will be sent to intending purchasers on application.

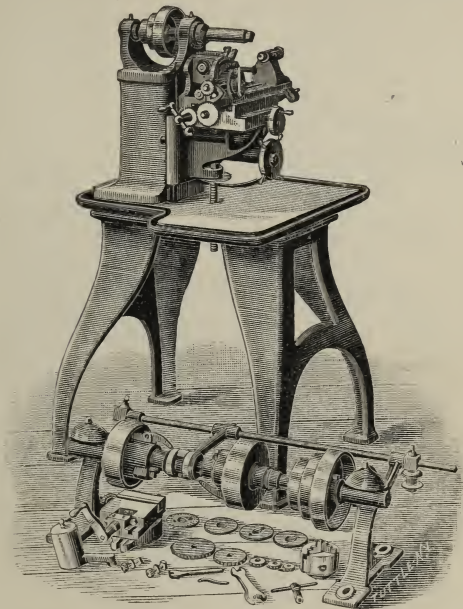
Thanking our friends for past favors, and soliciting a continuance of same we present the following pages, to your careful consideration.

Yours truly,

G. K. GARVIN, Prest.
F. W. GARVIN, Secy.
E. E. GARVIN, Treas.

THE GARVIN MACHINE CO.



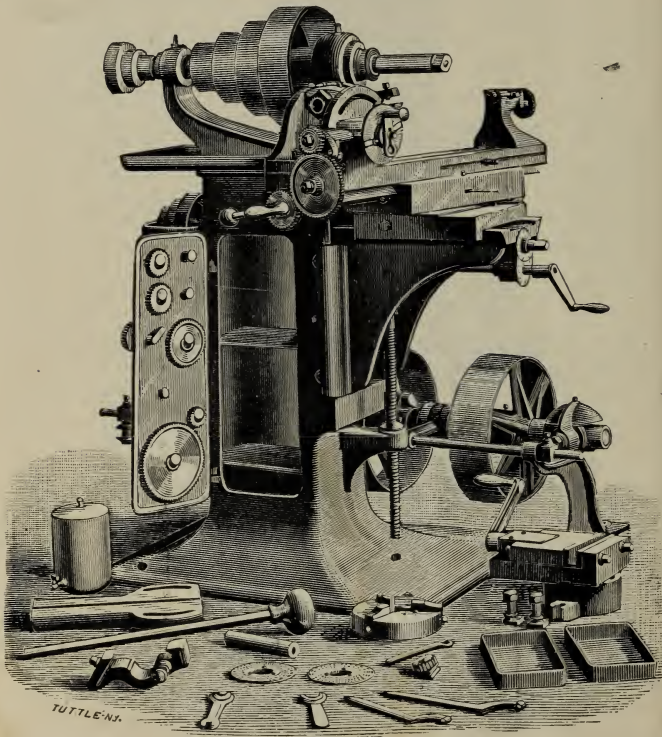


No. 0 Universal Milling Machine.

This is a light hand feed machine, designed for the most convenient handling of light tool work, model work and light manufacturing. The machine has all the features of the larger machines except the power feed, while its lightness makes it sensitive to the cut. The front spindle bearing is taper, with approved means of taking up wear, and both bearings are hardened and ground. The knee is adjusted by means of the hand wheel in front, and this adjustment together with that of the pan and slide, is to thousandths. The swivel block can be set 45° each way and solidly bound. The dividing head is similar in design to the larger size made by us and is, therefore, provided with a compensating worm gear, extended base and an effective and convenient arrangement for holding the trains of gears for cutting spirals. An extended index printed on wood, is furnished, giving the trains of gearing for a large number of spirals, together with their angles for various diameters. The dividing worm gear, elevating bevels and all feed screws are entirely protected at all times. The taper hole and thread for chuck on the dividing head spindle are interchangeable with those on the main spindle. A swivel vise, with graduated base, is furnished with the machine.

GENERAL DIMENSIONS.

Width of Belt, 1 inch.	Length it will take in and cut between centers, $7\frac{1}{2}$ inches.
Adjustment of knee, $5\frac{1}{2}$ inches.	Fricition pulleys, $6 \times 1\frac{1}{2}$ inches.
In and out adjustment of pan, $2\frac{3}{8}$ inches	Speeds of counter-shaft, 100 and 130
Length of slide, 16 inches.	Weight, 400 lbs.
Swing of centers, 6 inches.	
Price, \$475.	



No. 1 Universal Milling Machine.—(Patented.)

The extended use of machines of about this capacity, on tool work generally, led us to adopt this as the Standard machine for this class of work.

For dimensions and prices see page No. 16.

No. 1 Universal Milling Machine (Patented).

The Spindle is of large diameter, having a front bearing 4 9-16 ins. long and $2\frac{1}{8}$ ins. in diameter. It is hollow and will allow the passage of 11-16 in. stock. Both shoulders at the front bearing are provided with our standard hardened and ground anti-friction washers, and both bearings have ample adjustment for wear. The front end is threaded for the chuck which fits the spiral head, and the rear end carries the feed cone.

The machine having the arm is provided with our **Improved Form of Outboard Center**. This is arranged to allow for expansion due to the heat from the cutter, and at the same time to hold the end of the arbor perfectly firm.

The Table is 31 inches long, and has a bearing of 15 ins. in the swiveling block. The T slot extends the whole length, and both ends of it are accessible. The table can be fed 17 inches by power and 22 inches by hand. It has an adjustment to and from the face of the column of 6 inches, and a vertical adjustment of $15\frac{3}{8}$ inches. It can be swiveled 45 degrees either way from the straight position. The Screw is arranged to take gears for either simple or compound trains, and is provided with a compensating nut to allow for wear. The elevating and cross-feed screws are each provided with index circles reading to thousandths of an inch.

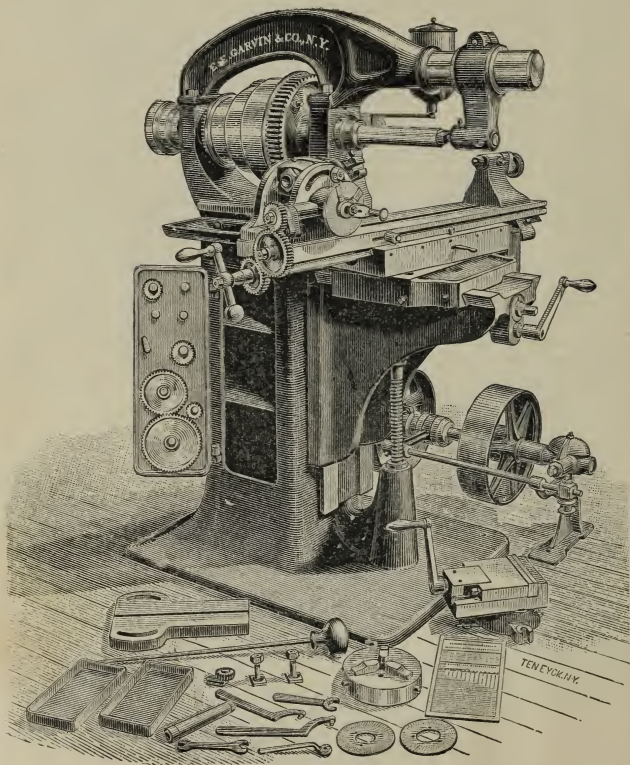
The Spiral Head has an extended base and **two** holding-down bolts, insuring great solidity. The spindle is hollow and will take in 11-16 in. stock. The taper socket in the spindle allows the interchange of tools between it and the main spindle. It is also fitted with a three-jawed Universal Chuck. The dividing worm gear is provided with our patent compensating wedge, which permits instant adjustment of the amount of slack in the worm. Three index plates are provided, by the use of which all numbers of divisions up to 50 can be obtained, and all up to 360, except a few prime numbers. The gearing is designed to cut a large number of spirals of even pitch, such as one turn in $1\frac{1}{2}$, 2, $2\frac{1}{4}$, 3 ins., etc. The manner of adjusting the gearing is very convenient, and the entire range of spirals from one turn in 1.33 inches to 133.33 are cut with a set of but 8 change gears. The head will swing $10\frac{1}{4}$ ins. and a spiral $14\frac{1}{2}$ ins. long can be cut.

The Tail Stock is of improved form and very solid design. The supporting point is close to the top, enabling cuts to be taken close to the center. The clamping device operates without altering the alignment of the centers.

The Feed has 3 changes, and operates with perfect freedom at whatever angle the table may be set. The feed mechanism is not carried by the table, but is attached to the swiveling block; this keeps the feed rod always in a straight line. The feed trip is very readily adjusted, and operates with the table running in either direction.

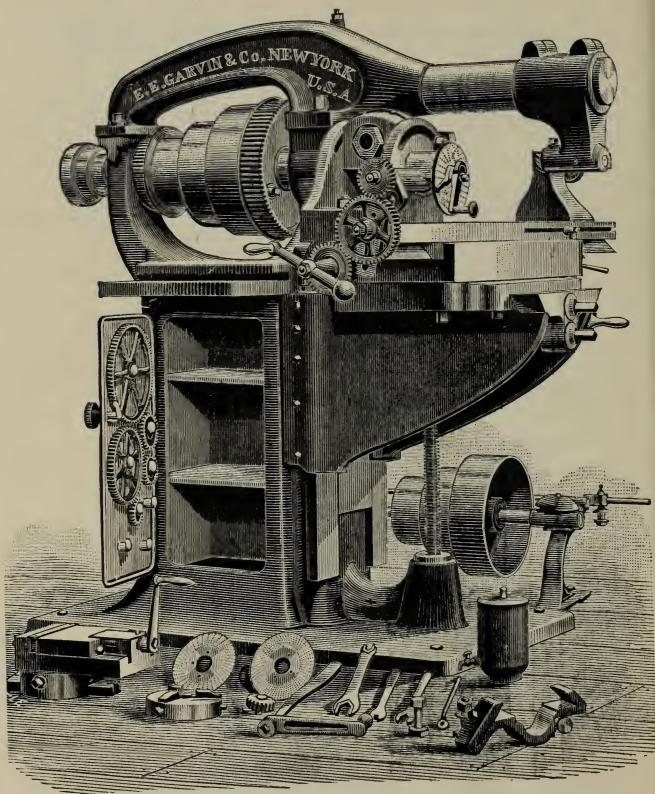
Shown in the cut are the various attachments that are furnished with the machine. A plate is provided on which the spiral head can be set at any angle with the spindle. The index tables for the dividing head stocks of all of our machines are **printed directly on the wood**, thus making them practically indestructible.

We would invite the attention of intending purchasers, who feel that they cannot afford a Universal Milling Machine, to our Nos. 2, 3, and $4\frac{1}{2}$ Milling Machines. These machines, when supplied with our dividing head and tail stock, will do all kinds of milling except spiral work. The item of first cost is largely in favor of the plain machine, and it can be operated by much cheaper help than is usually put on Universal Machines.



No. 2 Universal Milling Machine.—(Patented.)

This size machine does both small and medium heavy machine and tool work, and recommends itself as being a Universal Size.



No. 3 Universal Milling Machine.

A machine proportionately heavier than the No. 2 Universal Milling Machine and especially designed for the use of Steam Engine and Locomotive builders, and others requiring a heavy, solid machine capable of taking long heavy cuts.

No. 3 Universal Milling Machine.

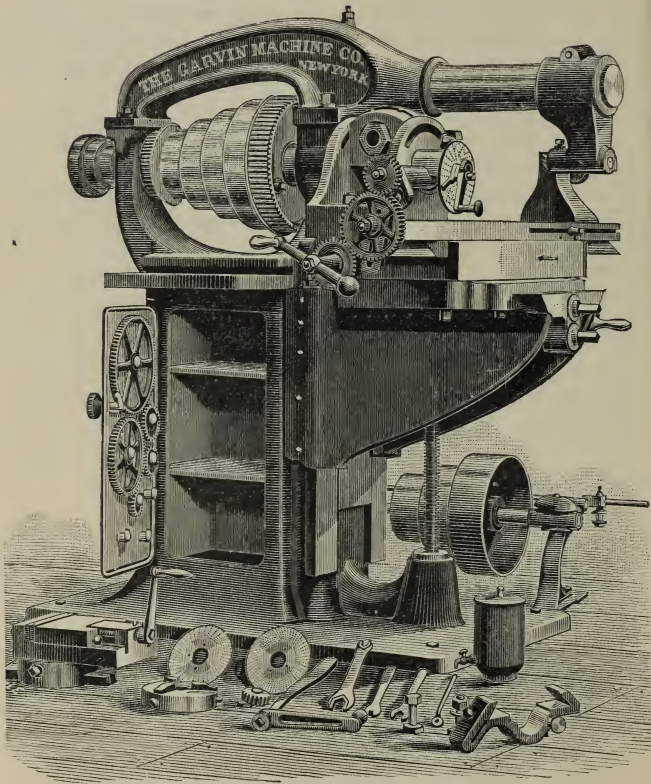
For work not requiring the full capacity of the No. 4 Universal, we have designed the new size illustrated on the opposite page; retaining all the features of the larger Machine, but with the dimensions suitably reduced.

The Spindle is of large size, having a front bearing 3 inches in diameter and $5\frac{1}{2}$ inches long. The front end has a thread which interchanges with that on the spiral head. The slide is heavy, with the T slot accessible at both ends. As with the other Universal machines the feed works are entirely protected at all times, and work with perfect freedom at whatever angle the table may be set, The feed trip acts with the table, running in either direction, and is readily adjusted to stop at any point. All shoulders on Screws are provided with means for taking up any slack that may occur from wear; and the table screw has a compensating nut, The Spiral head has our usual arrangement for holding the train of gearing and the compensating wedge is fitted in the dividing worm gear. The overhanging arm is $4\frac{1}{2}$ inches in diameter and 16 inches long; and the outboard center is of improved cylindrical form. The arbors are removed from the spindle by means of a drift, and the dividing spindle is hollow allowing the passage of $1\frac{1}{4}$ inch stock.

The machine is accompanied by a No. 5 Swivel Vise with graduated base and screw protected from chips and dirt. The countershaft is provided with 16x4 inch tight and loose pulleys to run 100 revolutions per minute. For latest improvements on this machine see page 95.

GENERAL DIMENSIONS.

Greatest distance between table and spindle.....	24½ in.
Least " " " " "	0 in.
Diameter of spindle	3 in.
Length of front bearing.....	5½ in.
" table	48 in.
" feed by power.....	24 in.
" " hand.....	32 in.
Length between centers.....	28 in.
Swing of centers.....	13 in.
Width of table	7 in.
Adjustment in and out.....	10¾ in.
Friction clutch pulleys.....	16x4 in.
Speed of countershaft.....	100 rev.
Weight complete.....	4000 lbs.
Price complete as shown.....	\$975 00



No. 4 Universal Milling Machine.—(Patented.)

This machine is intended for the largest kind of tool work, roll fluting, heavy gear cutting, gang milling etc., for which the large centers and long table offer special facilities

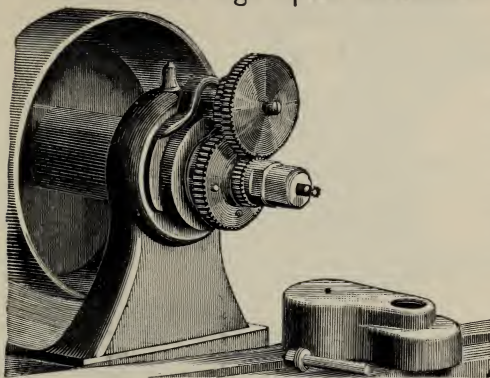
Description of No. 4 Universal Milling Machine.

This machine is designed for doing the heaviest class of work required of a Universal Machine. The special features of this machine are the result of over twenty years' experience in the jobbing and manufacturing trade. The feed is of the same character as our No. 1 Machine, and the same table of spirals applies. The table is long and rigid, trips feeding either direction, has a bearing more than half its length, and can be swiveled 45 degrees either way on the graduated pan, and solidly bound by bolts at the ends of the swivel block. There are the usual horizontal and vertical adjustments by thousandths of an inch. The arm, which may be taken off, is very heavy, and will take in an arbor 20 in. long, carrying a 10½ in. diameter cutter. The yoke is flattened off on the under side, thereby allowing small cutters to be used and the necessary passing over close to the top of the work. The spindle is 3 ins. diameter, and has drift slot for arbors and adjustment for end play. The front bearing is a cap box of ample length adjusted by the screw shown on the top. End play may be readily taken up in all shafts and feed screws, and the screw for the table has one of its two nuts adjustable lengthways to take up wear in the thread. The cone is 14 ins. diameter for a 4 in. belt, and is geared so that it will easily drive the heaviest cut that the machine is capable of taking. The dividing head will swing 15 ins., and possesses all the desirable features of the smaller size, the base of which is extended and has two holding down bolts. The swinging head can always be clamped at the most advantageous place. The dividing worm gear is split, and provided with our improved compensating wedge, and the arrangement for holding trains of gears for spiral cutting is effective and readily manipulated. The change gears not in use are hung on the inside of the door. The center on the tail spindle is close to the top, so that cuts can be taken close to the center line. The tail spindle is bound its whole length, and without throwing out of line. The spindle of the dividing head is hollow, allowing 1¼ stock to be passed through. The taper hole is the same as that in the spindle, and both have a standard taper of ½ inch per foot. In the swivel vise furnished the screw is protected from chips and dirt, and the construction allows angular cuts to be made with great facility, the base being graduated. For latest improvements on this machine see page 95.

GENERAL DIMENSIONS.

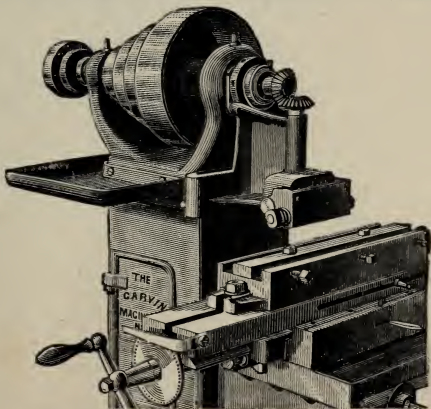
Distance from center of spindle to top of table at lowest point.....	21 in.
“ “ “ “ “ “ “ “ highest “	0 in.
Adjustment to and from face of column.....	10½ in.
Diameter of spindle.....	3 in.
Length of front bearing.....	5½ in.
Length of table	52 in.
Length of feed by power.....	28 in.
“ “ “ hand.....	36 in.
Width of table.....	8 in.
Swing of centers	15 in.
Length will take in between centers	28 in.
Tight and loose pulleys.....	16x4 in.
Speed of countershaft.....	100 revs.
Weight.....	4,300 lbs.
Price, with No. 5 Swivel Vise	\$1,150 00

The High Speed Attachment.



We have designed this attachment to fit either our No. 1 or 2 Universal Milling Machine, or the No. 2 or 3 Milling Machine. By the arrangement of the gearing the secondary spindle runs four times as fast as the main spindle. This large increase in speed makes it possible to use small and light cutters running at speeds suited to their diameters. The cutters are held in a spring chuck in the sec-

ondary spindle. The spindle has a long bearing, insuring stiffness with smoothness of motion. The illustration shows the gearing with the protecting cover removed. As an example of work done with the High Speed Attachment, we illustrate on page No. 97 a number of cuts on the edge of the Gear Stud Bracket on the Universal Milling Machine. Two of the grooves are each $\frac{1}{8} \times \frac{3}{32}$ in., and are made in one cut with a mill $\frac{1}{2}$ in. in diameter. Price, \$50.00.

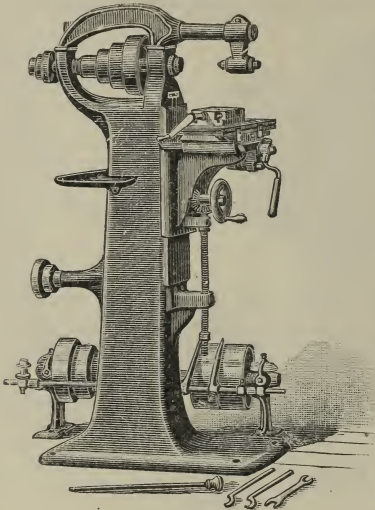


The Rack Cutting Attachment.

This attachment is made in two sizes; size No. 1 fitting the No. 1 Universal Milling Machine, No. 2 and 3 Milling Machines. The No. 2 attachment fits the No. 2 Universal Milling Machine, or the No. $4\frac{1}{2}$ Milling Machine. No. 1 attachment cuts racks from 10 P. to 32, while No. 2 attachment cuts from 6 P. to 10. A vise for holding racks accompanies each attachment, also the necessary indexing arrangement for cutting the above pitches.

Price, No. 1.....\$90 00. No. 2.....\$100 00.

See Page 39 for Vertical Spindle Attachment.



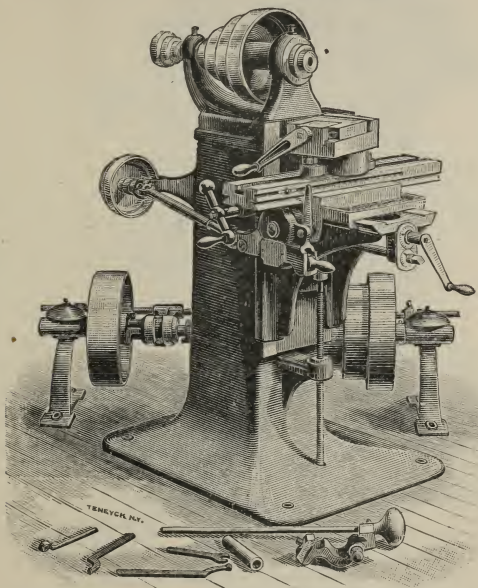
No. 1 Milling Machine.

This machine is designed for rapid and convenient milling of small work. The base is of a rectangular form and contains a cupboard. The spindle has a front bearing 1 5-16 in. diameter and $3\frac{1}{4}$ in. long. Both bearings run in composition metal boxes, and are provided with means for adjustment. The spindle can also be adjusted by a nut bearing on the spindle cone. Spindle cone has 4 changes of speed for a 2 inch belt, and is fastened to the spindle with a key. The table can be depressed 12 ins. below the center, by the vertical adjustment of the knee, and it has a 12 inch automatic rack and pinion feed, transmitted through a clutch by means of self-oiled worms and worm-gears located inside the column, thus keeping them free from dust and chips. A quick return motion is obtained from a lever fastened to the pinion shaft. The transverse motion is derived from a screw operated by a crank wrench. The feed is stopped by a roller, fastened to the lever, sliding over a pin which disengages the clutch. The feed cone has 3 changes of speed, and is 1 in. face, and has the advantage of using an extra long belt. The table is $4\frac{5}{8}$ in. wide and 21 in. long, cast with a grooved projection on all sides to receive oil and chips. Countershaft is provided with adjustable and self oiling hangers.

GENERAL DIMENSIONS.

Table.....	21 in. long. $4\frac{5}{8}$ in. wide.
Feed of table.....	12 in.
Carriage depressed from center.....	12 in.
Transverse motion of carriage.....	3 in.
Front bearing of spindle.....	$3\frac{1}{4}$ in. long, 1 5-16 in. diam.
Tight and loose pulleys on countershaft.....	8x2 $\frac{1}{2}$ in. face.
Speed of countershaft.....	165 rev.
Weight of machine complete.....	575 lbs.
Price, as shown in cut, with arm and No. 2 vise.....	\$240 00
Price, with No. 2 vise, but without arm.....	225 00

No. 2 Milling Machine.



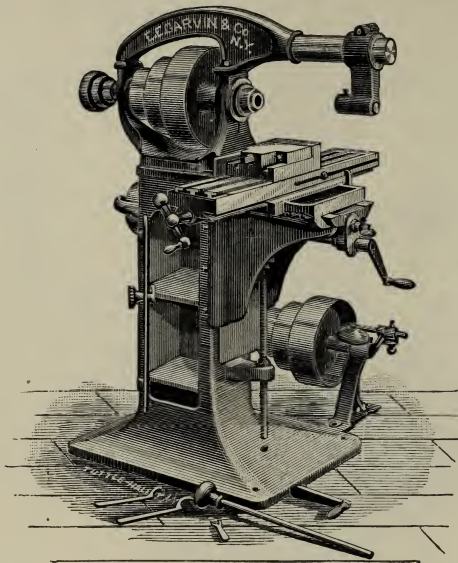
This machine, together with 10 in. centers (described on page 33), is designed to meet the wants of tool makers, machinists and others requiring an accurate dividing and well made milling machine. The dividing head, feed of table and micrometer adjustments are the same as those of the No. 1 Universal Milling Machine, and for all general purposes, except spiral cutting, this machine will do equally well. The spindle is of steel and has an 11-16 inch hole its entire length, which is tapered up to $\frac{1}{4}$ in. diameter at its front end

for the reception of tools. The threads and tapers ($\frac{1}{2}$ in. to the foot) in the end of both milling machine and dividing head stock spindles being the same, allow tools fitted to either to interchange. The boxes are composition metal and are provided with ready means of compensation for wear. The spindle is driven by a $2\frac{1}{4}$ in. belt on a cone pulley of four grades. There are three changes of feed. A plunger is provided for removing cutter arbors from spindle. The feed screw is double thread, giving quick return movement. Stops are provided for hand feed, and the trip is so arranged that it will operate with the carriage traveling either way. On the cross slide and elevating screws are index circles with graduations in thousandths of an inch. The feed gearing is inaccessible to dirt and chips, being on front of machine enclosed in a neat iron box. The feed worm is self-oiling, being surrounded by an oil box. Countershaft has adjustable self-oiling boxes and the friction clutch pulleys are arranged to give eight uniform changes of spindle speed. When machine is furnished with centers, as described on page 28, a 6 in. milling chuck is included without extra charge.

GENERAL DIMENSIONS.

Distance from center of spindle to top of table at lowest point	17 $\frac{1}{2}$ in.
Distance from center of spindle to top of table at highest point	0 in.
Diameter of spindle	$2\frac{1}{8}$ in.
Length of front bearing	4 in.
“ table	28 in.

Length of feed	14 $\frac{1}{2}$ in.
Width of table	5 $\frac{1}{8}$ in.
Adjustment to and from column	6 in.
Friction clutch pulleys	14x4 in.
Speed of countershaft	145 & 110 rev.
Weight, complete	1,160 lbs.
Price, as shown in cut, with No. 4 swivel vise	\$350 00

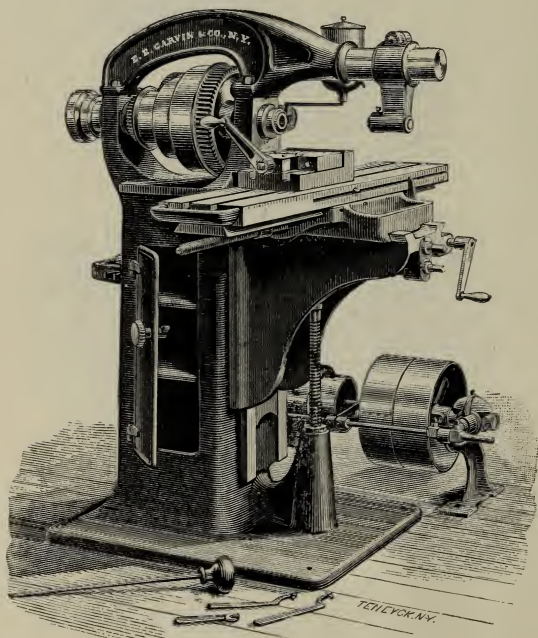


No. 3 Milling Machine.

This is a somewhat less powerful machine than the No. 4, but has special advantages in the facility of adjustment and means for securing work, which the table affords. The spindle is hollow and runs in adjustable composition boxes. The three speed cone is 12 in. diameter, for $3\frac{1}{2}$ in. belt. The machine will take a cut 14 in. out from face of column, with cutters 9 in. diameter. The arbor bearing in the yoke is the standard straight hole style. The table has three T slots and a wide and long bearing on the pan. The slide is adjustable horizontally and vertically, to thousandths of an inch. The feed works, of hardened steel, are well protected and readily accessible. Means are provided throughout the machine for taking up wear.

GENERAL DIMENSIONS.

Distance from center of spindle to top of table at lowest point.....	17 $\frac{1}{2}$ in.
“ “ “ “ “ “ “ highest “	0 in.
Adjustment to and from face of column.....	6 $\frac{3}{4}$ in.
Diameter of spindle.....	2 $\frac{3}{8}$ in.
Length of Table.....	34 in.
Width “	7 $\frac{1}{2}$ in.
Length of feed.....	17 $\frac{3}{4}$ in.
Tight and loose pulleys.....	14x4 in.
Speed of countershaft.....	100 rev.
Weight.....	1,275 lbs.
Price, complete as shown.....	\$375 00



No. 4 $\frac{1}{2}$ Milling Machine.

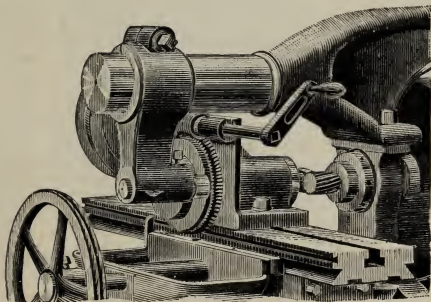
This machine is about the same size as the No. 2 Universal and is well adapted for taking heavy cuts on medium large work. It will be found well suited for such work as cutting steel gears of coarse pitch, gang milling, etc.

Description of No. 4½ Milling Machine.

The spindle is hollow and runs in adjustable composition boxes. The cone is 12 in. diameter, for 3½ in. belt. The machine will take a cut 15 in. from face of column with cutters 9 in. diameter. The arbor bearing in the yoke is a straight hole as on the No. 5 Milling Machine. The table has two T slots the entire length and a long bearing on the pan. The knee is heavy and the slide is adjustable horizontally and vertically to thousandths of an inch. The feed is by screw which is connected with a shaft at the side for hand feed and quick return. The feed works, of hardened steel, are well protected and readily accessible. Means for taking up wear are provided throughout the machine. For latest improvements on this machine see page 95.

GENERAL DIMENSIONS.

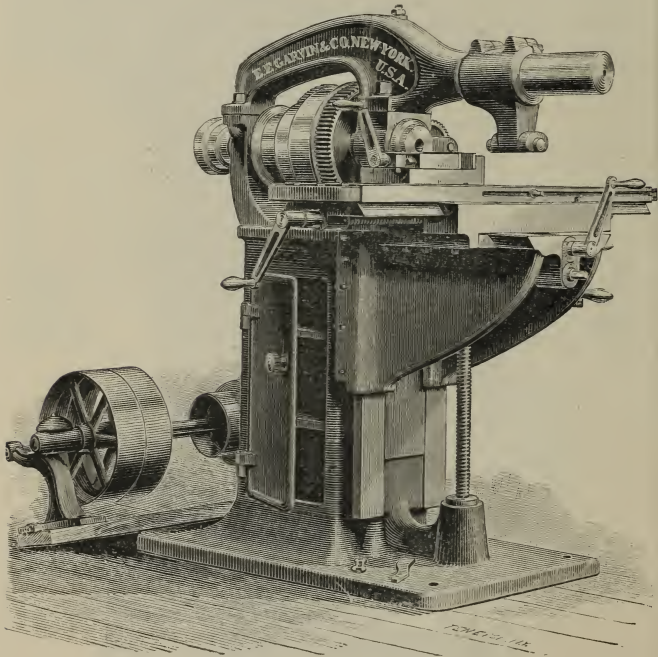
Distance from center of spindle to top of table at lowest point... ..	19 in.
“ “ “ “ “ “ “ highest “	0 in.
Adjustment to and from face of column.....	8 in.
Length of table.....	42 in.
Width “	9 in.
Length of feed	27 in.
Tight and loose pulleys.....	14x4 in.
Speed of countershaft.....	160 rev.
Weight.....	2,200 lbs.
Price, complete as shown.....	\$550.00



Cam Cutting Fixture.

This simple device can be applied to any Milling Machine having an arm and a rack feed table. The former pin is fixed in the yoke in line with the spindle, and a weight, attached to the table, keeps the former or model pressed up against the pin. The former and work are rotated by worm and gear which may be driven by hand or power.

Price..... **\$75 00**



No. 5 Milling Machine.

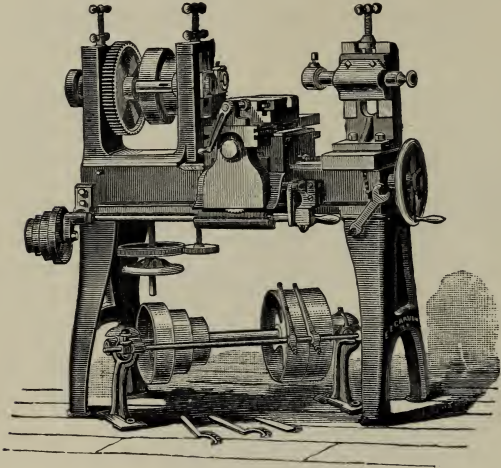
This machine is intended for plain heavy work of large size, and with the aid of large gang and face mills much of the work commonly done on the planer can be handled in a superior manner and at reduced cost.

Description of No. 5 Milling Machine

The machine here shown is heavily built throughout and intended for the heaviest class of plain milling. The column, knee, spindle, cone and arm being the same as the No. 4 Universal Milling Machine. The table has a bearing for more than half its length and is of sufficient depth to prevent springing from bolting on of work, for which purpose there are four T slots its entire length. The table has pans at both ends and the vertical and horizontal adjustments are in one-thousandths of an inch, indicated on a dial with adjustable pointers. The feed is by screw and perfectly steady under light or heavy cuts or changes from one to the other. The trip is readily adjusted and is operated by the table feeding either way. End play may be taken up in all feed screws and shafts, and, as in the No. 3 Universal, one of the nuts of the feed screw for the table is adjustable for wear in the thread. The knee is square gibbed to the column, which insures solidity at this important point. The arm is of substantial proportions and sufficient length to take in an arbor 20 in. long and carrying cutters 10½ in. diameter giving a very wide range for gang milling. The flattening of the under side of the arbor support will be found to be of great advantage in many cases. The outer centre for the arbor is a split straight hole, hardened and ground, with screw adjustment for wear. The end of the arbor is hardened and ground to fit. This center is in common use and gives general satisfaction. The upper half of the front box for the spindle is alone adjustable. As all the wear occurs in the upper part of the box this arrangement assures the alignment remaining perfect. There are three changes of feed and the cone is geared up more strongly than is the No. 4 Universal in order to have sufficient power to carry broad, heavy cuts. A No. 5 vise goes with the machine, in which, as in all the vises, the screw is protected from chips and dirt. For latest improvements on this machine, see page 95.

GENERAL DIMENSIONS.

Distance from center of spindle to top of table at lowest point.....	23 in.
“ “ “ “ “ highest “	0 in.
Adjustment to and from face of column	9¼ in.
Length of table.....	56 in.
Width of table.....	14½ in.
Length of feed by power.....	37½ in.
“ “ “ “ hand.....	48 in.
Diameter of Spindle.....	3 in.
Tight and loose pulleys.....	16 x 4 in.
Speed of countershaft.	100 rev.
Weight.....	4,050 lbs.
Price with No. 5 vise.....	\$750 00

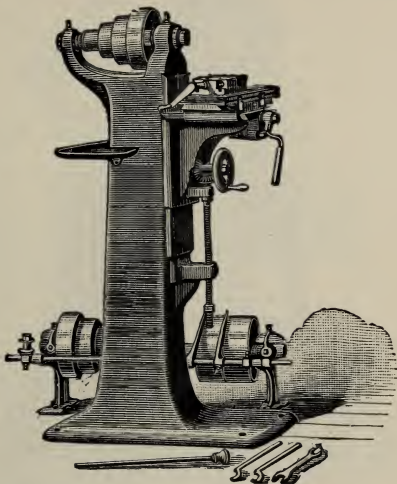


Improved Milling Machine. LINCOLN PATTERN.

We are now building this machine from entirely new patterns, and one of the chief features is making the tail stock adjustable to any part of the bed. The improved form of cylindrical center is used, doing away with the necessity for nuts on the tail spindle. This makes adjustment quick and easy. The spindle has a standard taper hole, $1\frac{1}{4}$ inches in diameter and 6 inches deep. The spindle can by means of screws be raised to 8 inches from the table, or lowered to $3\frac{1}{4}$ inches. The table is 28 inches long and $7\frac{1}{2}$ inches wide, and has an adjustment of 6 inches to and from the head. Allowance is made for swiveling the head. Spindle cone has three changes of speed, and feed cone four. The feed worm runs in oil, and is protected from dust and chips by a neat cast iron box. We are also prepared to furnish this machine with an extended block allowing a travel of 36 inches, at an additional price of \$70.00. The countershaft is provided with self-oiling hangers.

GENERAL DIMENSIONS,

Tight and loose pulleys..	12x3 in, face.
Speed of countershaft...	190 rev.
Weight of machine complete..	1,325 lbs.
Price, including No. 5 vise and tail stock complete.....	\$330 00
Price, including No. 5 vise, without tail stock.....	310 00
Price, without vise or tail stock.....	290 00

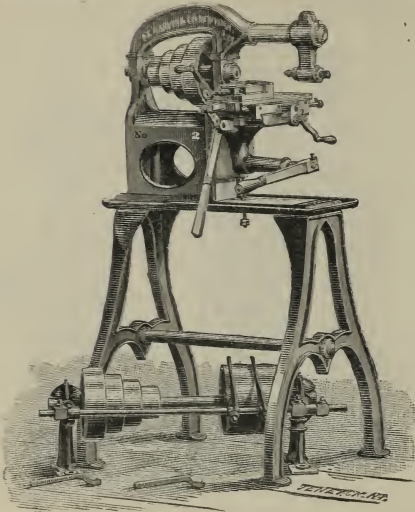


No. 1 Hand Milling Machine.

This machine, with the No. 1 machine (described on page 18,) is designed for those requiring rapid manipulation of small work. Jewelers, brass workers and sewing machine manufacturers will find them well adapted to supply a long felt want. This machine is the same as the No. 1 machine, with the exception of the automatic feed being replaced by a hand feed, which is operated by a lever fastened to a pinion shaft, giving a very direct motion and a quick return. Adjustable stops are placed on the table for regulating the motion. This machine is furnished with a No. 2 vise (described on page 34) and a dividing head can be furnished arranged for cutting gears and pinions either on centers or in a spring chuck. Countershaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS.

Table.....	16 in. long, 4 $\frac{5}{8}$ in. wide.
Feed of table.....	7 in.
Carriage depressed from center.....	12 in.
Transverse motion of carriage.....	3 in.
Front bearing of spindle.....	3 $\frac{1}{4}$ in. long, 1 5-16 in. diam.
Tight and loose pulleys on countershaft.....	8x2 $\frac{1}{2}$ in. face.
Speed of countershaft.....	165 rev.
Weight.	475 lbs.
Price, as shown in cut.....	\$185 00
“ with arm.....	200 00



No. 2 Hand Milling Machine

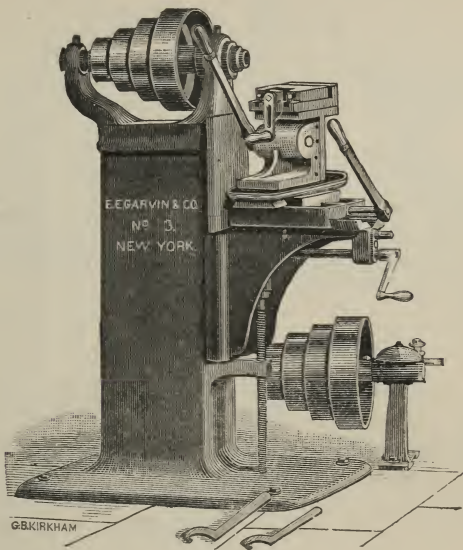
AND

SCREW-HEAD SLOTTER, COMBINED.

This machine is well arranged for taking short milling cuts, and can be operated with ease and rapidity. The box-shaped head is mounted on a planed iron table, which is surrounded by a groove to catch oil and chips. The cross slide is adjusted by a screw that projects in front, squared for a wrench. The sliding table is operated by a hand lever, and the motion is gauged by an adjustable stop behind. A vertical movement is communicated to the knee slide by means of a rack and gear, operated by a hand lever in front as shown in the cut. We can, in place of this rack and pinion, arrange a screw which is operated by a hand wheel beneath the table if it is desired. The spindle is of steel and a 17-32 in. hole clear through it, tapered in front for shank of arbor. The boxes are of composition metal, with adjustments for wear. For slotting screws a sliding vise is furnished, so arranged that the front or movable jaw tightens on the screw to be slotted by means of two springs under the jaw. The jaw is linked so that it is operated wholly by the hand lever which feeds the vise. With the machine with the lever vertical motion, as per cut, screws can also be fed up under the saw, which greatly increases its capacity. Countershaft has adjustable self-oiling hangers.

GENERAL DIMENSIONS.

Length of feed table.....	15 in.
Width " ".....	4 $\frac{5}{8}$ in.
Length of feed.....	6 in.
Distance from center of spindle to top of table, when down.....	4 $\frac{1}{2}$ in.
" " " " " up.....	$\frac{1}{2}$ in.
Tight and loose pulleys on countershaft.....	8x3 in.
Speed of countershaft.....	150 rev.
Weight, complete.....	415 lbs.
Price, with No. 2 vise.....	\$174 00
" with arm and vise, as shown in cut.....	189 00
" of screw slotter vise, extra.....	25 00



No. 3 Hand Milling Machine.

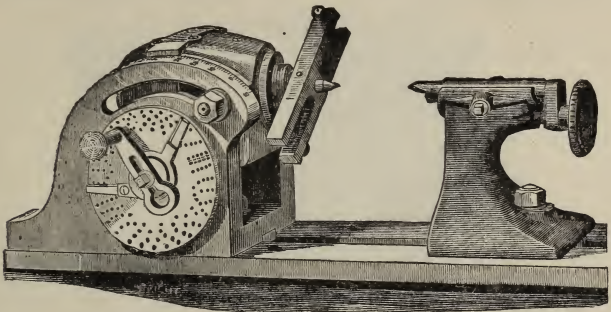
This machine is adapted to making two or more short cuts on different planes. The body of the machine is of the cupboard style. The spindle is of steel, $2\frac{1}{8}$ ins. diameter; front bearing, 4 ins. long. It is driven by a $2\frac{3}{4}$ in. belt, passing over a cone pulley of four grades of speed— $4\frac{1}{2}$, $6\frac{1}{2}$, $8\frac{1}{2}$, $10\frac{1}{2}$, ins. diameter. The spindle runs in composition metal boxes with ample means of adjustment for wear. The vertical range of carriage is from center to $17\frac{1}{2}$ ins. below the center. The adjustment to and from the base is 6 ins., and the transverse movement is 6 ins. Countershaft hangers are adjustable and self oiling.

GENERAL DIMENSIONS.

Vertical movement of upper slide.....	2 in.
Tight and loose pulleys.....	12x3 in. face.
Speed of countershaft.....	120 rev.
Weight of machine, complete.....	1,000 lbs.
Price, as shown in cut, with No. 3 vise.....	\$250 00

Dimensions and Prices of Plain and Hand Milling Machines.

	No. 1.	No. 1½.	No. 2.	No. 3.	No. 4. Screw or rack feed.	No. 4. Geared.	No. 4½.	No. 5.	Lincoln Miller.	No. 1. Hand.	No. 2. Hand.	No. 3. Hand.
Greatest dist. bet. spindle & table.	12 in.	12 in.	17½ in.	17½ in.	12 in.	14 in.	19 in.	23 in.	8 in.	12 in.	4½ in.	17½ in.
Least " " " "	0	0	0	0	1	1	0	0	4¾	0	½	0
Diameter of spindle.....	1⅝	1¾	2⅞	2⅞	1⅝	1⅝	2¼	3	2⅝	1⅝	1⅝	2⅞
Length of front bearing.....	3¼	3¾	4	4½	4⅞	4⅞	4⅞	5⅞	3¾	3¼	2⅞	4
" " table.....	21	24	28	34	30	30	42	56	28	16	15	
" " feed by power.....	12	13	14½	17¾	16	16	27	37½	19			
" " " hand.....	12	15	14½	22	18	18	28	41½	19	7	6	6
Width of table.....	3¾	4¼	5⅞	7½	6	6	9	14½	7½	4⅝	4⅝	5
Adjustment in and out.....	3	4	6	6¾	5	5	8	9¾	6	3	2	6
Size of vise (page 34), accompanying machine.	2	3	4	4	4	4	5	5	5	2	2	3
Countershaft pulleys, T. & L. ...	8x2½	10x2½	Friction 14x3	14x4	14x4	10x3¾ 12x3½	14x4	16x4	12x3	8x2½	8x3	12x3
Speed of countershaft, revs.....	165	125	110	100	100	110x240	160	100	190	165	150	120
Weight complete, lbs.....	575	800	1160	1275	1450	1500	2200	4050	1325	475	415	1000
Price, with arm.....	\$240	\$300	\$350	\$375	\$350	\$375	\$550	\$750	\$330	\$200	\$189	
Price, without arm.....	\$225	\$280	\$350		\$300				\$310	\$185	\$174	\$250
" " vise or tail stock.....									290			

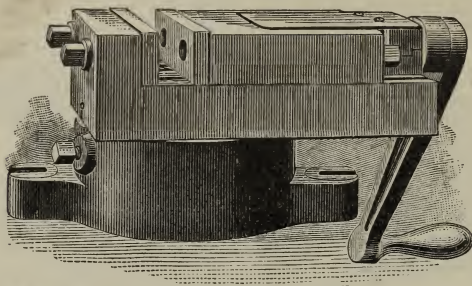


Dividing Head and Tail Stock.

This head is well adapted to the use for which it was designed. It is compact and well made, and will compare favorably with any tool of this class in the market. Our latest improvements comprise a patented compensating wedge for adjusting the halves of the spacing worm gear, and an alteration of the tail stock pattern so that milling cutters adjusted close to the center pass clear across. The wedge, which can be reached from without, gives a positive adjustment and effectually prevents the halves being forced back to their original position. We have extended the base of the head stock and put in an additional holding down bolt, which increases the rigidity of the head, particularly noticeable in cutting bevel gears and other overhanging work which cannot be supported by the tail stock center. Gears can be accurately spaced, mills cut of straight, conical, or irregular forms, taps and reamers fluted and worm wheels gashed. The slots in the stock allow the head to be elevated from a horizontal to a vertical position, and by supplemental slots in the elevating head in which the T heads of clamp bolts slide, the head can be depressed to 30 degrees below a horizontal line and 5 degrees beyond a vertical, making 125 degrees of arc, all determined by graduations on stock. The spacing worm gear is made in halves, and all points liable to wear are provided with means of compensation. Three index dials accompany the head, dividing all numbers up to 50, and as many others as an every-day machine shop practice may demand. The spindle of elevating head has a taper hole clear through, and the end of the spindle is threaded to receive chuck, allowing pieces of any length and less than 1 and $\frac{1}{8}$ in. diameter to be milled. The tongues under the bases of head and tail stocks are of steel and can be removed to allow swiveling of head, so that work held in the chuck, such as hollow mills, etc., can be cut under or hooking. The tail stock has a milled head adjusting screw and screw to bind spindle central in any position. These centers are designed to be used on our No. 2 MILLING MACHINES, but can be used on other milling, shaping and planing machines. Our 15 inch dividing head, as used with the No. 4 Universal Milling Machine, is the same in detail as the 10 inch described, except that all parts are larger and stronger in proportion, the head stock spindle allowing $\frac{1}{4}$ inch stock to be passed through.

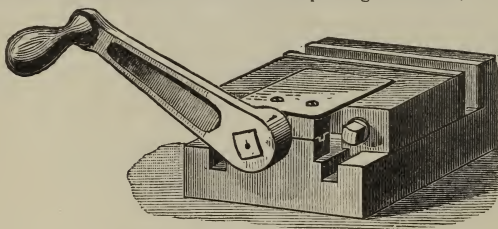
GENERAL DIMENSIONS.

Capacity of arc.....	125 degr.
Swing of centers.....	10 in.
Price of 6 in. complete, with wrenches and dials.....	\$1 00 00
10 in. " " " " " ".....	1 35 00
12 in. " " " " " ".....	1 75 00
15 in. " " " " " ".....	2 00 00



Swivel Vise.

This shows a regular vise, having a beveled friction disc on the under side, mounted on a graduated base on which it can be securely fastened at any angle by two binder screws bearing on the friction disc. One of these binder screws is shown in the cut. Each size of vise has a corresponding swivel base.

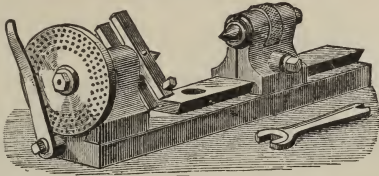


Milling Machine Vises.

We make five sizes of this vise, with tool steel jaws and screws. Screw and cap covered with sheet steel to prevent wear from dust and dirt.

	No.	2	3	4	5	6
Depth of Jaw.....		$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
Width ".....		4.	5	$5\frac{1}{8}$	7	$10\frac{1}{2}$
Opens without Steel Jaw.....		$1\frac{1}{8}$	$2\frac{5}{8}$	$3\frac{3}{8}$	4	$7\frac{1}{8}$
Weight.....		$8\frac{1}{2}$	20	30	47	175
Price, plain.....		\$14.	\$16.	\$18.	\$22.	\$40.
Price, swivel.....		\$20.	\$23.	\$25.	\$30.	\$55.

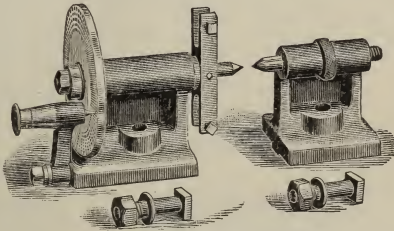
No. 1 Index Centers.



These centers will swing a diameter of $2\frac{3}{4}$ inches, and will take in a length of $7\frac{3}{4}$ inches. The extreme length of bed is $15\frac{1}{2}$ inches. The index dial has four rows of 24, 30, 36 and 42 holes respectively.

Price..... \$22 00

No. 2 Index Centers.

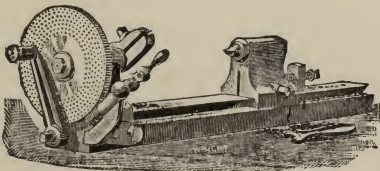


These centers will swing a diameter of 6 inches, and are designed to be used on the No. 1 Milling Machine, but can be used on any machine. The dial index is accurately drilled, in circles of 48, 56, 60, 66 and 72 holes, and a special head is made to use split collets.

Price as shown.....\$30 00

Price arranged for split collets... 45 00

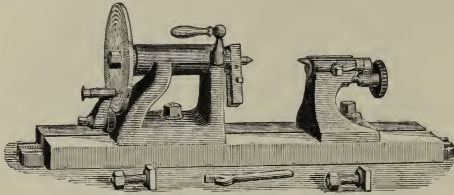
No. 3 Index Centers.



These centers have dial moved by worm. They will swing a diameter of $5\frac{3}{8}$ inches, and take in a length of 15 inches. Extreme length of bed is $29\frac{3}{4}$ inches. Dial is provided with rows of 44, 48, 56, 72, 84 and 96 holes respectively.

Price as shown in cut\$45 00

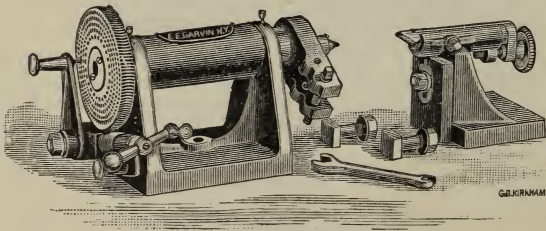
No. 4 Index Centers.



These centers swing 10 inches, and will on a 29½ inch bed take in 16 inches in length. The Index Plate has 7 circles of holes numbering, 4, 6, 54, 64, 70, 77, and 84 respectively. The head and tail spindles can both be solidly bound for taking heavy cuts relieving the index pin of all strain.

Weight, with base.....	88 lbs.
Price, " "	\$50 00
" without "	40 00

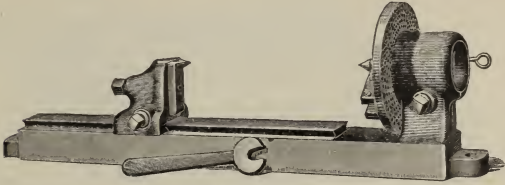
No. 5 Index Centers.



These Planer Centers will swing a diameter of 12 ins., are of substantial proportions and well made, and will hold rigidly any work that comes within their range. The head and tail stocks are provided with steel tongue pieces to preserve the alignment. There is a worm and gear for turning and holding the head stock spindle, thus relieving the index pin and holes of all strain, and the attendant wear and loss of accuracy. The worm gear has five accurately drilled circles of holes as follows: 26, 44, 54, 64 and 70. The worm can be dropped out of gear when it is desired to turn the dial without it. The tail stock spindle has a vertical adjustment for handling taper work.

The head and tail together weigh.....	90 lbs.
Price.....	\$65 00

"Every Day" Centers.



CAPACITY—Will Take in a Piece 6 in. Diameter and 16 in. Long.

WEIGHT, 45 POUNDS.

FIVE INDEX CIRCLES

Divided into 60, 56, 54, 52 and 48 holes respectively. Index Plate, Spindle and Dogging Plate cast in one piece. Tail Stock moved into position and Clamped. Centers Hardened. Heads of all Screws fit the same Wrench. All parts manufactured in duplicate by Special Tools, which enables us to place them on the market at the extremely low price of **\$20.00.**

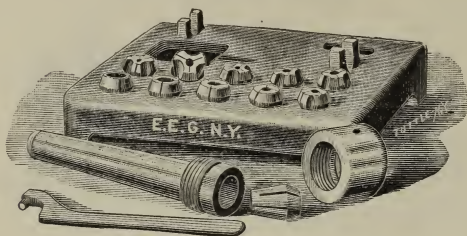
Universal Three and Four Spindle Milling Centers.

We build two sizes of the above, and they are designed for fluting taps or holding any light work which is to be milled by an index. The head spindles, which chuck and dog the work to be fluted or milled, are geared together, so that all the spindles are universally operated by one index. The large size of 4 spindles is 2 ins. between centers. The small size of 4 spindles is $1\frac{1}{4}$ ins. between centers. The small size of 3 spindles is $1\frac{1}{8}$ ins. between centers. The head and tail are planed to a base, which we can furnish of any desired length.

Prices on application.

Index Centers.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	Every Day.
Swing.	$2\frac{3}{4}$	6	$5\frac{3}{8}$	10	12	6
Will take in.	$7\frac{3}{4}$		15	16		16
Extreme length of bed.	$15\frac{1}{2}$		$29\frac{3}{4}$	$29\frac{1}{2}$		27
Weight.	8	12	45	88	90	45
Price as shown.	\$22.00	\$30.00	\$45.00	\$50.00	\$65.00	\$20.00
Price, without base plate.				\$40.00		



Spring Chucks.

These chucks are designed to hold the double-ended butt mills shown on page 91. The collets are all interchangeable and are made in 11 sizes, ranging from $\frac{1}{8}$ inch to $\frac{3}{4}$ inch by 16ths.

We furnish the chucks with shanks fitting the following machines at the accompanying prices:

No. 0 Universal Milling Machine.....	\$26 00
No. 1 Universal Milling Machine.....	30 00
No. 2 Universal Milling Machine.....	30 00
No. 3 Universal Milling Machine.....	34 00
No. 4 Universal Milling Machine.....	34 00
No. 2 Milling Machine.....	30 00
No. 3 Milling Machine.....	30 00
Profiling Machine.....	26 00

Extra size Collets at special prices.

Milling Machine Collets for holding taper shank mills.

Collets for No. 1 Universal Milling Machine, No. 2 Miller, No. 3 Miller, No. 3 Hand Miller and No. $4\frac{1}{2}$ Miller.

Price.....\$2 50

For No. 0 Universal Milling Machine, No. 1 Hand Miller, No. 2 Hand Miller, No. 1 Miller and Profiler.

Price.....\$1 75

For No. 3 and No. 4 Universal Milling Machine and No. 5 Miller.

Price.....\$4 50

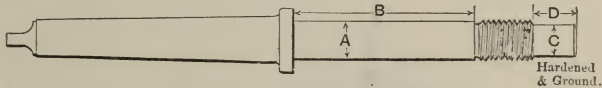
Nut and Bolt Attachment to Plain Milling Machine.

We are building an attachment for Plain Milling Machines which is designed to facilitate milling, either square or hexagon heads, or nuts. The Milling gang for a hexagon consists of six cutters in pairs, and the pieces to be milled are held in the top of a turret provided with the necessary indexing arrangement. After the first three cuts are taken; a nut is finished at each cut and a new blank can be inserted while the machine is running. This reduces the loss of time in putting in the pieces to a minimum. A Gang of four mills is used for square work. The turret is locked by a hardened pin seated in hardened and ground bushings, insuring accuracy and firmness. Weight, 90 lbs.

Price on application.

Arbors for Milling Machines.

We have in stock the arbors enumerated in the following list. They are made from selected stock and are provided with hardened Nuts and Cast Iron Collars, which are carefully faced and finished all over.



MACHINES.	A	B	C	D	PRICE
No. 0 Universal Milling Machine.....	$\frac{5}{8}$	$3\frac{3}{8}$			\$ 4 50
“ 1 Universal Milling Machine.....	1	$5\frac{7}{16}$			5 50
“ 1 Universal Milling Machine, with arm..	1	$5\frac{7}{16}$	$\frac{3}{4}$	$1\frac{1}{4}$	6 00
“ 2 Universal Milling Machine.....	1	8	$\frac{3}{4}$	$1\frac{1}{4}$	9 00
“ 3 Universal Milling Machine.....	$1\frac{1}{4}$	12	$\frac{7}{8}$	$1\frac{1}{4}$	12 00
“ 4 Universal Milling Machine.....	$1\frac{1}{4}$	14	$\frac{7}{8}$	$1\frac{1}{4}$	15 00
“ 1 Milling Machine.....	$\frac{5}{8}$	$3\frac{3}{8}$			4 50
“ 2 Milling Machine.....	1	$5\frac{7}{16}$			5 50
“ 3 Milling Machine.....	1	$5\frac{7}{16}$	$\frac{3}{4}$	$1\frac{1}{4}$	6 00
“ 4 Milling Machine.....	1	$5\frac{3}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	7 50
“ 4½ Milling Machine.....	1	8	$\frac{3}{4}$	$1\frac{1}{4}$	9 00
“ 5 Milling Machine.....	$1\frac{1}{4}$	12	$\frac{7}{8}$	$1\frac{1}{4}$	12 00
Lincoln Pattern Miller.....	1	$7\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{4}$	9 00
No. 1 Hand Milling Machine.....	$\frac{5}{8}$	$3\frac{3}{8}$			4 50
“ 2 Hand Milling Machine.....	$\frac{5}{8}$	$3\frac{3}{8}$			4 50
“ 3 Hand Milling Machine.....	1	$5\frac{7}{16}$	$\frac{3}{4}$	$1\frac{1}{4}$	5 50
Single Spindle Milling Machine, Vertical Table.....	1	$5\frac{3}{4}$	$\frac{3}{4}$	$1\frac{1}{4}$	7 50
Cutter Grinder.....	$\frac{1}{2}$	$\frac{5}{8}$			2 50
Screw Slotter.....	$\frac{5}{8}$	$\frac{1}{4}$			2 50
Automatic Gear Cutter.....	$\frac{7}{8}$	$\frac{5}{8}$			2 50
Small Gear Cutter.....	$\frac{1}{2}$	$\frac{5}{16}$			2 50

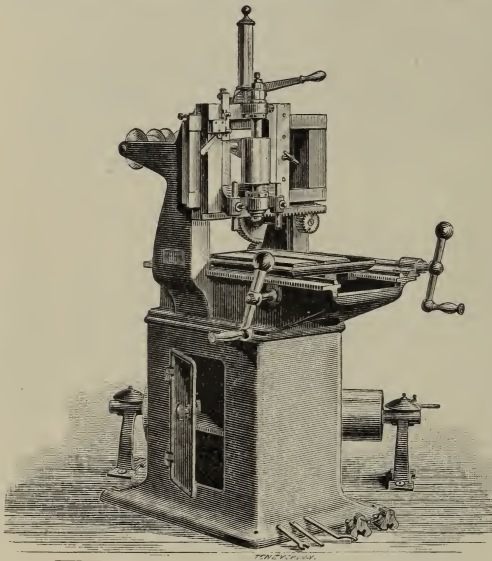
Vertical Spindle Attachment.

These attachments are made in sizes similar to the Rack Cutting Attachment, and the same plan is followed in attaching them to the respective machines. (See cut on page 17.) With attachments of this character, work can be laid flat on the machine table without resorting to the common method of securing same to angle plate. Work done with this attachment is always in plain sight, and it will prove a valuable addition to any machine.

- No. 1 Attachment will fit No. 1 Universal Miller, Nos. 2 and 3 Milling Machines.
 No. 2 Attachment fits No. 2 Universal Miller and No. 4½ Milling Machine.
- Price, No. 1.....\$50 00
 “ No. 2..... 65 00

PROFILE OR EDGING MACHINE,

SPECIALLY ADAPTED AND USED AS A
VERTICAL SPINDLE MILLING MACHINE.



This cut represents our latest efforts towards making this a more convenient and perfect running machine. In this style of a machine the operator has easy control over the cutter, and as the work is always in plain sight, and quickly handled, it strongly recommends itself to those who at present are doing their work in an expensive and unsatisfactory way.

They are profitably employed in spotting off and facing work, die sinking, key seating, edge milling, milling T slots, irregular shapes or surface cam cutting, either large, with the former secured on top, or small, with the former placed on one side, using the

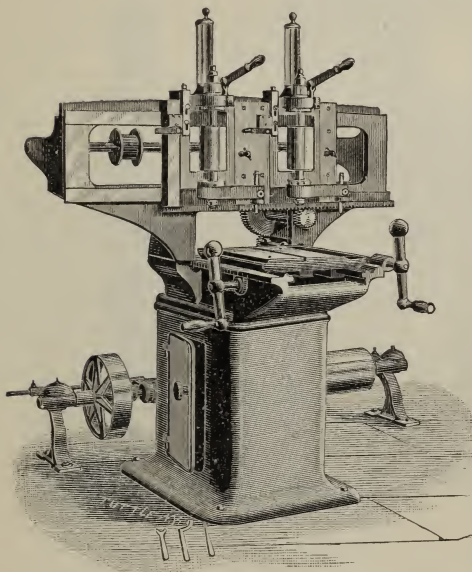
former pin. Plain work that simply needs facing off can be perfectly finished, and should the cuts be on different planes the notched stop on the spindle slide allows the cutter to drop from one to the other with perfect accuracy.

The spindle is driven by a belt running from the countershaft over sliding idler pulleys, which gives a strong uniform drive. Change of speed is made by using cones on the countershafts. The four motions necessary in this class of machine are accomplished by rack and pinion movement in connection with two ball handles conveniently located. Allowance is made for taking up all the wear and lost motion in the racks and gears. The spindle slide is fitted with two former pin sockets, so that the spindle can be employed in cutting a former from a sample piece, and then, by carrying the former pin to the other socket, the former is used in the position in which it was milled. The spindle slide is balanced by a spring acting against a notch, with screw adjustment especially valuable when it is used to do surface work with a butt mill. Stops are provided both ways, for the cross slide and the table slide. Friction pulleys of two speeds go with the machine.

GENERAL DIMENSIONS.

Countershaft should run for slow speed.....	75 revs.	Diameter of spindle.....	1 5-16 in.
Ditto for fast speed.....	150 revs.	Up and down movement do....	3/8 in.
Working surface of table.....	14x10 in.	Tight and loose pulleys, 14x3 & 8x3 in.	
Movement of table.....	18 in.	Weight.....	1,425 lbs
“ “ cross slide.....	11 in.	Price, as shown in cut...\$	375 00
Distance from bed to cross slide, 5 1/2 in.		Price of extra countershaft, giving six spindle speeds...\$	18 00

TWO SPINDLE PROFILING MACHINE.



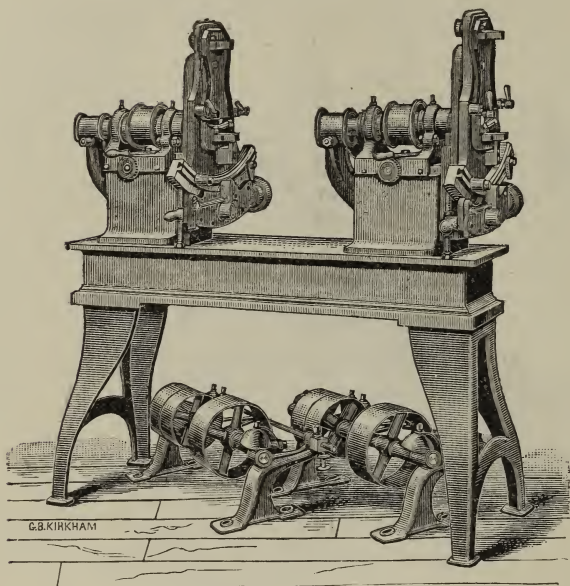
In designing this Profiler, we have added materially to the capacity of the previous machine as shown on the opposite page. The addition of the second spindle enables two cuts to be taken on the edge of a piece at one setting, such as a roughing and finishing cut. The No. 1 Profiler has $3\frac{1}{2}$ in. between spindles and No. 2 has 7 inches. Where profiling work requires the use of two mills in succession, the advantage gained by having two spindles, each with its independent stops, and former pin, is easily to be seen. The vertical stop consists of a notched plate and lock bolt. This bolt is withdrawn by a lever handle when the spindle is to be moved vertically. The weight of the spindle is balanced

by a coiler spring whose tension can be altered to suit the weight of different mills. The arrangement of the operating handles shown has proved to be very convenient, as they are both within easy reach when standing where the best view of the work can be obtained. All motions by rack and pinion are provided with effective means for taking up all slack in the gearing. This feature is essential to good work when turning corners in following an irregular outline. The spindles are driven by one long belt passing from countershaft drum and under sliding idler pulleys. This gives a very steady motion to the spindles, and furnishes ample power for the heaviest cuts with mills adapted to the machine. A friction countershaft of two speeds accompanies each machine.

GENERAL DIMENSIONS.

Countershaft should run for slow speed.....	75 revs.
Ditto should run for fast sp.	150 revs.
Working surface of table.....	14x10 in.
Movement of table.....	18 in.
Distance between sp. No. 1.....	$3\frac{1}{2}$ in.
“ “ “ “ 2.....	7 in.
Distance from bed to cross slide.....	$5\frac{1}{2}$ in.
Diameter of spindles.....	$1\frac{5}{8}$ in.

Up & down movement of spindles.....	$3\frac{1}{2}$ in.
Friction clutch pulleys.....	14x3 & 8x3 in.
Weight No. 1.....	1,875 lbs.
“ “ 2.....	2,184 “
Price, No. 1.....	\$550 00
“ “ 2.....	700 00
“ of ex. countershaft giving 6 spindle speed.....	18 00



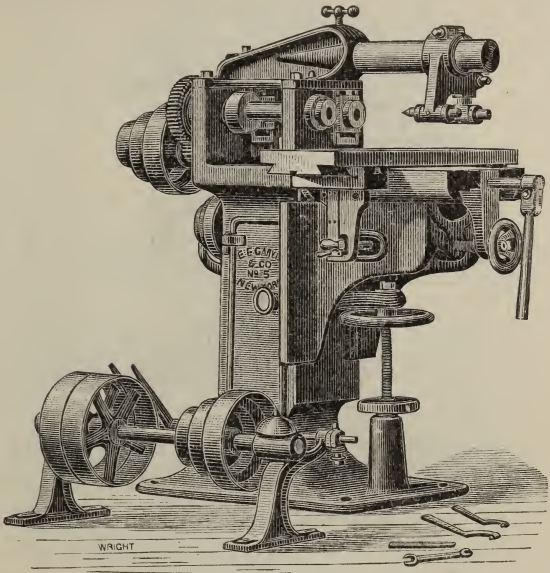
Shuttle Race Miller.

This machine is designed specially for milling the curved slot in which a sewing machine shuttle is moved, but can be used on any work where a finished curved slot is desired. The work, such as a Sewing Machine bed plate, is quickly fastened to the swinging plate by cam binders, and the feed is by a worm meshing with work gear teeth cut on the edge of the plate. This worm is automatically dropped out of gear at the end of the cut, when the feed stops.

The radius of the curved slot is determined by the distance from the center of the pin on which the plate swings to the center of the spindle.

The machine is made double headed, so that one head may be used for the roughing cut and the other for finishing, or, if not so used, it still makes a very compact arrangement of two machines. The machine is also made single headed. The spindle is furnished with split taper bushings for holding the cutters, which latter are made of straight drawn steel.

Price on application.



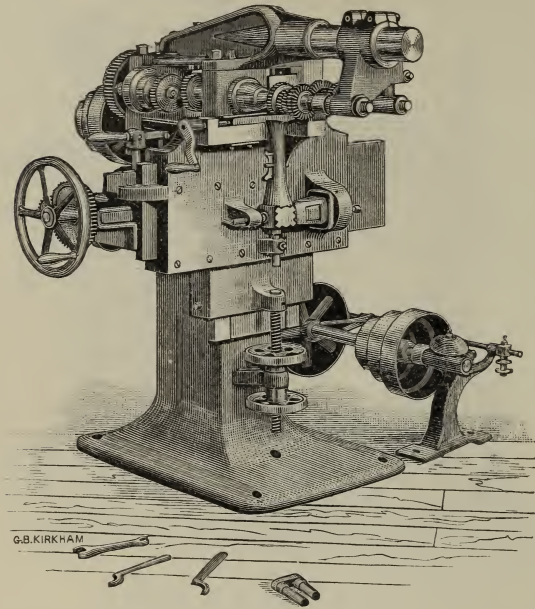
Two-Spindle Milling Machine.

This is a heavy machine, particularly well adapted for manufacturing purposes. It has two spindles so placed that one is in advance of the other, making it possible to take a roughing and finishing cut at one setting, thus effecting a great saving in time. The spindle for the finishing cutter has a fine vertical adjustment, so that work can be very accurately milled to gauge. The feed, which has three changes, is by rack and pinion, with lever for quick return. The spindles are both geared and driven from the same cone, which has three speeds for 3 in. belt. There is an outer supporting center for each cutter arbor, while still allowing free access to the work. The table is wide and heavy, affording a solid support for large jigs, etc.

GENERAL DIMENSIONS

Vertical adjustment of knee.....	.8 in.
Horizontal adjustment of slide.....	.6 in.
Length of slide.....	.36 in.
feed.....	.16 in.
Width of slide on top.....	.10 in.
Diameter of spindles at front bearing.....	.2 3-16 in
Distance between spindles.....	.5 in.
Diameter of tight and loose pulleys.....	12x3 in.
Speed of countershaft.....	180 rev.
Weight.....	1,900 lbs.

Price on application.



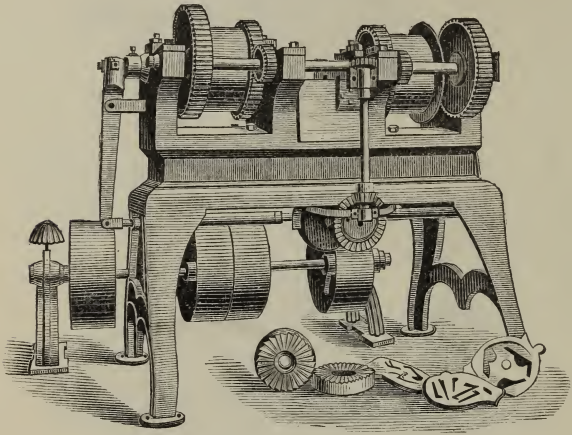
Two-Spindle Milling Machine, Vertical Table.

This machine is especially designed for milling sewing machine arms, but can be used on any work where it is convenient to hold the jig in a vertical position. The table is heavy, 12 ins. wide and 24 ins. long, and slides in a bearing on the knee, which is $33\frac{1}{4}$ ins. long, so that the table has a bearing its entire length. There is ample vertical adjustment of the knee on the face of the column. The feed is by rack and pinion connected with a hand wheel, that is geared up for quick return. The two spindles are so placed that the finishing cut is just commencing as the roughing cut is done, making but one setting necessary. The finishing spindle has a fine vertical adjustment of $1\frac{1}{2}$ ins. below the other. There is an outside supporting center for each cutter arbor, without interfering with the free access to the work. Both spindles are geared and driven from the same cone, which has three speeds for $2\frac{1}{2}$ in. belt. There are also three changes of feed with automatic trip.

GENERAL DIMENSIONS.

Length of feed.....	14 in.
Diameter of spindles at front bearing.....	2 3-16 in.
Distance between center of spindles.....	5 $\frac{1}{4}$ in.
Diameter of tight and loose pulleys.....	12x3 in.
Speed of countershaft.....	180 rev.
Weight.....	1700 lbs.

Price on application.



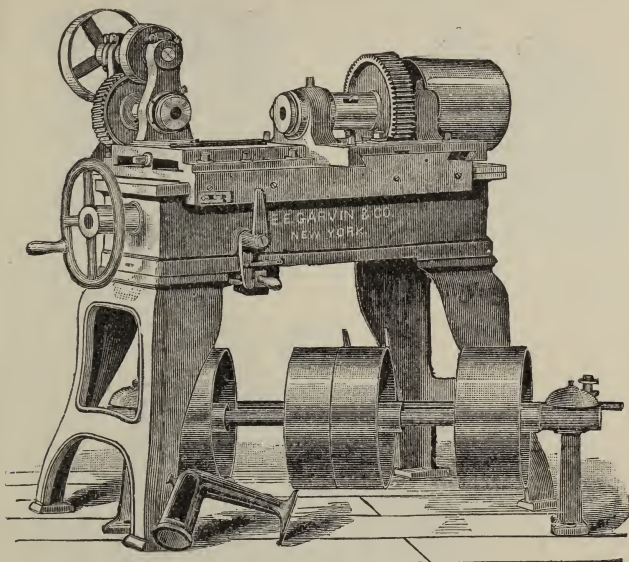
Double Head Face Milling Machine.

This machine is well arranged for milling work, with two parallel sides. It is driven by compound gearing, and will carry face mills as large as 11 ins. in diameter. The feed is automatic, and is operated by a worm and worm gear. The heads are $9\frac{1}{2}$ ins. apart, with a strong pan, firmly secured, filling the space. To this the holder is attached that receives the work that is to be milled. When milling wrought iron or steel, the pan is filled with oil or soda water. This method of milling is very expeditious and reliable.

GENERAL DIMENSIONS.

The spindles are.....	$2\frac{1}{2}$ in. diam. x 26 in. long.
The thread on spindles to hold cutters.....	2 in. diam. x $1\frac{1}{2}$ in. long.
The motion of or feed of spindles, each.....	$\frac{3}{8}$ in.
Pulleys on countershaft.....	16x6 in. face
No. of turns countershaft should make for 11 in. mills.....	120
“ “ “ “ “ 6 “.....	150
Weight of machine and countershaft, about.....	2,500 lbs.

Price on application.



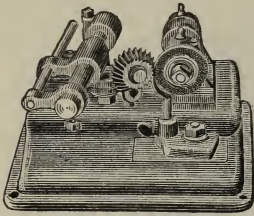
Compound Milling Machine.

PATENTED.

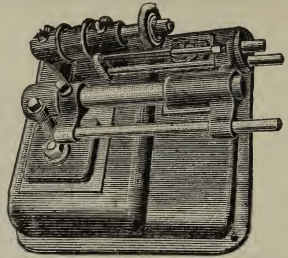
This machine is designed to mill, simultaneously, the two cuts upon a sewing machine arm at right angles to each other, saving 50 per cent. in time over the old method. One spindle is stationary, while the other, mounted on a cross slide carried on the main table, is given the necessary cross motion by means of a block moving in a diagonal slot fixed in the bed. It is particularly noteworthy that the milled surfaces are bound to be always square with one another, independent of the setting of the casting or jig, for the squareness depends on the slides of the machine, not on the perfect clamping of one surface. The fixed spindle carriage is adjustable in and out at the back side of the machine, and the plate on which the jig is placed is adjustable in the direction of the length of the moving spindle. Various ratios between the lengths of the two cuts can be obtained by swiveling the plate in which is the diagonal slot. It will be seen that the machine is applicable to a wide range of conditions. The spindles are strongly geared, and the table and bed are substantially built, and provided with liberal bearing surfaces. Every provision is made for taking up wear both in spindles and slides.

Weight, with countershaft.....1,750 lbs.

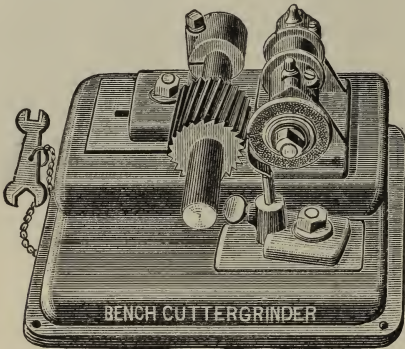
Price on application.



Grinding Bevel Cutters.



Grinding Taper Reamers.



Bench Cutter Grinder.

This small machine has ample capacity for all the ordinary sizes and varieties of milling cutters, while its compactness and small cost render it practicable to have several distributed around the shop in the vicinity of each group of Milling Machines, where they will prove a valuable addition to the plant and soon pay for themselves in time saved.

The machine is well made throughout and will grind mills and shell reamers, cut spiral or straight, from 5 in. diameter and 4 in. face, down to the smallest; side or face mills, bevel or angle cutters, from 8 in. diameter down; reamers, hand, machine, rose and taper, as large as 1½ in. diameter and 8 in. long; butt mills, either straight or taper; cutters for milling T slots and hollow mills, such as used on Screw Machines. Saws, cutters for gear teeth, drills and all such tools, as are generally ground by hand, can also be handled.

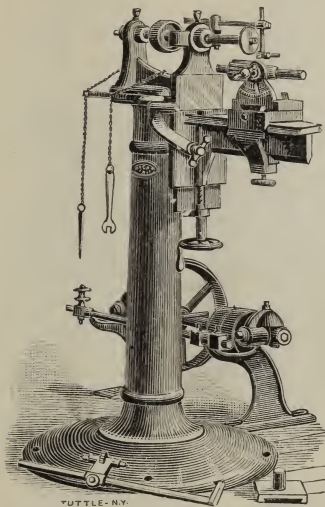
Both spindle and arbor are of steel hardened and ground, the latter to 1 in. standard size. All adjusting screws and nuts are case hardened and fit wrench attached to the machine.

The machine can be placed on the bench where most convenient, and driven by straight or quarter turn belt.

A single hanger countershaft with 4½ x 2 in. T. & L. pulleys completes the machine.
 Speed of countershaft.....600 rev.
 Price, complete with emery wheel, as shown in cut.....\$35 00
 Price mounted on column.....42 50

Cutter Grinding Machine.

SHOWN WITH SURFACE GRINDER ATTACHED.



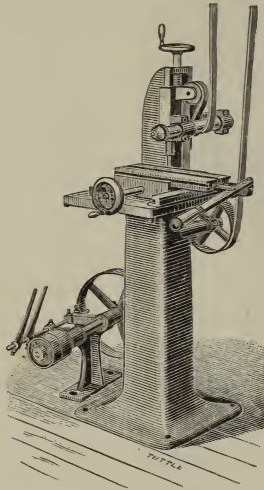
TUTTLE-N.Y.

We desire to call special attention to the several improvements which we have recently made in our machine for grinding cutters. The construction has been simplified by substituting a planed knee for the heavy stud in former use. A sliding platform, made to move more freely than in the old style machine, is fitted to this knee and is bound in any desired position by tightening a gib by means of a hand screw shown beneath. A special attachment is also provided for this machine, when required, for surface grinding. The machine can be changed from a cutter grinder to a surface grinder in a few minutes. Upon the sliding platform is a stand capable of being held by a cam binder at any desired angle. This stand is used for mandrel stud, and has a graduated arc of 90 degrees for setting the stud at any angle. The centers shown in cut enable the operator

to sharpen reamers and taps of almost any shape. With this machine all sizes and shapes of cutters can be handled, from 1/2 in. to 8 1/2 ins. diameter, and face mills, by using platform shown at foot of machine, up to 12 ins. diameter. The arrangement is such that plenty of space is allowed for the hands in sliding the work upon the mandrel. The slide and spindle bearings are sheathed and covered with cap nuts for the exclusion of dust and emery. The spindle boxes have adjustment for wear, and the sliding surfaces are substantially gibbed. The surface grinder will grind a piece 10 ins. long and 8 ins. wide. The slide is operated by a rack and pinion movement, making it very sensitive and quickly handled. The cross feed is operated by a screw attached to the end of the knee. This attachment is very useful in grinding small, hardened work, such as straight edges, cutting dies, calipers, gauges, etc., Small pieces can be held in a vise made fast to the side for that purpose. Drift and wrenches accompany the machine. Countershaft hangers adjustable and self-oiling.

GENERAL DIMENSIONS

Tight and loose pulleys on countershaft.....	4 1/2 x 2 in. face.
Speed of countershaft.....	400 rev.
Weight of machine, complete.....	400 lbs.
Price.....	\$ 135 00
“ of surface grinding attachment and No. 2 vise	50 00
“ centers.....	10 00
“ extra platform for face mills.....	3 00
“ arbor for emery wheel.....	2 50

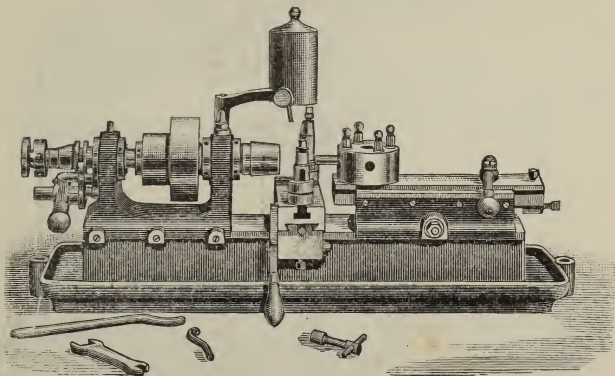


Die Grinder.

This is a very desirable tool, designed particularly for use in connection with punch presses for grinding and sharpening dies, punches, &c. It is also well adapted for general use as a small surface grinder. The slide is traversed by hand by means of the lever shown, which makes a simple machine and secures quick work. The spindle has a vertical adjustment of 7 inches by a screw, providing ample room for running wheels of large diameter. The spindle bearings are oiled by screw top oil cups, thus effectually excluding all dust and emery. The plan of belting this machine puts a loop in the belt, which allows belting direct and dispenses with a tightener. The table has transverse screw adjustment of $6\frac{3}{8}$ inch, and is provided with a T slot for holding work. A surface 6x8 inches can be ground at one setting of the machine. The countershaft has tight and loose pulleys $4\frac{1}{2} \times 2$ in. and should run 400 revs. per min.

GENERAL DIMENSIONS.

Length of Table.....	15 inches.	Length of Traverse.....	8 inches.
Width ".....	5 "	Width ".....	$6\frac{3}{8}$ "
Max. distance bet. spindle and table 7 in.		Min. distance bet. spindle and table 0 in.	
	Size of Arbor $\frac{1}{2}$ in. will take a wheel $\frac{5}{8}$ in. thick.		
Price, including Countershaft and Emery Wheel.....	\$100 00		



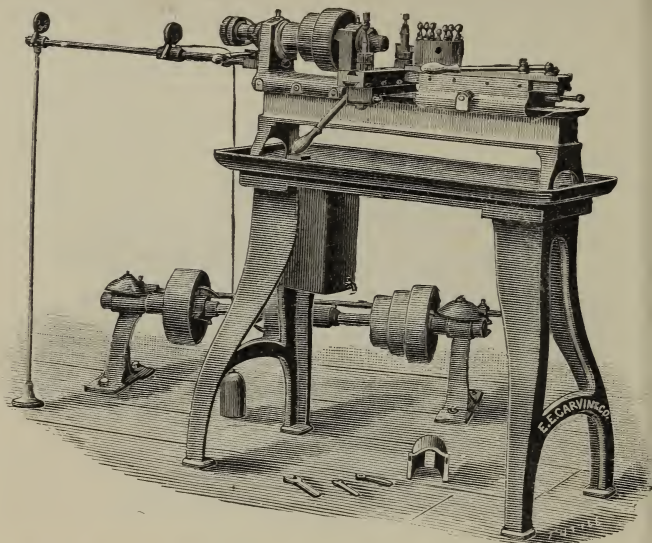
No. 00 Screw Machine For Bench.

This size screw machine is designed for very small, quick work, requiring a light sensitive machine. All parts are made in the best manner. The sliding surfaces are scraped to a perfect bearing, and the spindle boxes thoroughly fitted and provided with means of taking up wear, while parts subject to very severe wear, such as the turret mechanism, are hardened. The turret slide has an adjustable stop, and the block can be bound anywhere along the bed. The cut-off slide has two tool posts, with adjustable stop for each. For holding work we make a set of hardened spring bushings, ranging from No. 30 guage down to the smallest. On these machines, all kinds of small shoulder screws, handles, knobs, washers, collars, pins, etc., can be turned out with great rapidity, accuracy and finish. The wire chuck, which acts with the machine in motion, is worked by the handle at the end of the head. One stroke of the lever releases the grip of the chuck and allows the wire to pass in through the hollow spindle, while the return stroke tightens the chuck and binds the wire.

GENERAL DIMENSIONS.

Swing over bed.....	6 in.
Movement of turret slide.....	2 in.
Number of holes in turret.....	6
Diameter of holes in turret.....	7-16 in.
Diameter of hole through wire feed spindle.....	5-16 in.

Counter friction pulley.....	6x2 in.
Weight.....	200 lbs.
Speed of countershaft.....	320 revs.
Price, as shown with wire feed.....	\$300 00
Price, mounted on column	3 15 00
" without wire feed.	240 00

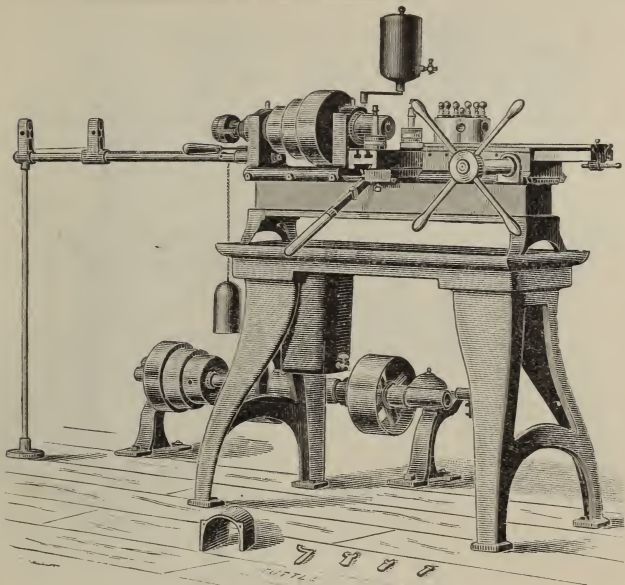


No. 1 Screw Machine, with Wire Feed.—(Patented.)

This is similar to the No. 2 Machine in design and construction, and like it, is made with and without wire feed. The machine is shown with the wire feed, and is adapted for making steel screws 1-16 to $\frac{3}{8}$ ins. diameter, and doing every kind of light, quick work for which these machines are so generally used. The wire feed used in these machines acts instantly with the machine in motion, and does not pull nor mar the wire in gripping. One stroke of the lever releases the grip of the chuck on the wire which feeds forward, and the return stroke again tightens the chuck. The chuck is a tempered spring collet working in a hardened and ground taper shell in the end of the spindle. This brings the chuck close to the bearing and thus secures great solidity, noticeable in taking broad cuts. The wire feed apparatus has discs of hardened steel with holes arranged in a circle for various sizes of wire, which act as bushings and have the advantage of always being ready, which facilitates setting up the machine. We furnish to order a set of spring collets from an $\frac{1}{8}$ to $\frac{1}{2}$ in. by thirty-seconds for the wire feed. The spindle bearings are bronze cap boxes, and all sliding surfaces are scraped to a bearing. Means are provided throughout the machine for taking up wear and preserving the alignment. The cone is 6 in. diameter for 2 in. belt. The turret has six holes for the reception of tools, and works easily and quickly. The plain machine is identical with the wire feed, except as with the No. 2 Machine the capacity is increased. One chuck, 1 drip pot, 1 stop and the necessary case hardened wrench, with the countershaft, complete a machine, and are included in the price.

GENERAL DIMENSIONS.

Wire feed capacity.....	$\frac{1}{8}$ to $\frac{1}{2}$ rod.	Friction clutch pulleys.....	8x8 in.
Without wire feed, cap'y....	$\frac{1}{8}$ to $\frac{3}{4}$ in.	Speed of countershaft.....	225 rev.
Diameter of turret.....	4 $\frac{1}{2}$ ins.	Weight complete.....	425 lbs.
“ holes in turret.....	11-16 in.	Price with wire feed.....	\$375 00
Movement of turret slides.....	3 ins.	“ without wire feed..	275 00
Swing over the bed.....	9 in.		

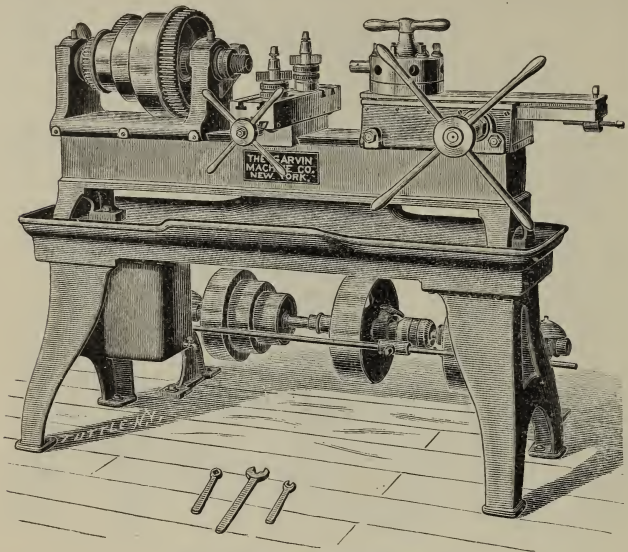


No. 2 Screw Machine.

We make this size in two styles, one with wire feed, and the other without. The addition of wire feed to this class of machines has more than double their capacity of work per day. Two motions of a lever feed the stock forward and clamp it ready for another operation. The stock is held by a spring collet, which, while holding it firmly, does so without marring it. The collets keep the stock central, enabling one to use stock which is the finished size of part of the screw or piece. The turret has six holes for the reception of tools. The indexing mechanism for the turret is of hardened steel, and is strong and substantial. The locking pin is hardened and ground, and works in an adjustable taper bushing, and fits into hardened taper sockets in the under side of the turret. The turret slide has a screw stop, and the bearing block is readily adjusted along the bed. The cross slide has two tool posts which are each provided with elevating collars, which give a fine and parallel adjustment for tools. The slide is provided with a screw stop, and is moved by a capstan head or lever as may be ordered. The spindle bearings are bronze cap boxes, and all sliding surfaces are scraped to a bearing. The cone is $8\frac{1}{2}$ inches in diameter and has three speeds for $2\frac{1}{2}$ inch belt. There is a large reservoir in the bed of the machine, into which the oil drains and is drawn off at the bottom. The wire feed machine which we have described is identical with the plain machine in all other particulars, except that the spindle capacity of the plain machine is somewhat greater. One chuck, one drip pot, one stop, the necessary case hardened wrenches, with the countershaft, complete a machine, and are included in the price.

GENERAL DIMENSIONS.

Wire feed capacity.....	$\frac{1}{8}$ to $\frac{3}{8}$ in.	Swing over bed.....	$10\frac{1}{2}$ in.
Without wire feed.....	$\frac{1}{8}$ to 1 3-16 in.	Friction clutch pulleys.....	10x4 in.
Diameter of turret.....	6 in.	Speed of countershaft.....	200 revs.
" " holes in turret.....	1 in.	Weight, complete.....	850 lbs.
Movement of turret slide.....	$5\frac{3}{4}$ in.	Price, with wire feed.....	\$450 00
Diameter of spindle.....	$2\frac{1}{8}$ in.	" without " 	350 00



No. 3 Screw Machine.

A machine of sufficient power and spindle capacity to make screws and studs of from $\frac{3}{8}$ to 1 inch in diameter, from rods of steel, iron or brass. It is also adapted for threading steam and gas pipe fittings, tapping and facing nuts, &c. With proper forming tools in the cross slide a great variety of pieces of irregular outline can be handily and cheaply made. The cut off slide is moved either by rack and pinion, or by a screw as may be ordered. We build this size of machine either plain, with plain back gears, with friction clutch permitting the instant engaging or disengaging of the back gears without stopping the machine, and with or without wire feed. When especially ordered a power feed is applied to the turret slide. The machine is driven by a three step cone for a three inch belt. A friction countershaft and the necessary wrenches, spanners, &c., accompany each machine.

GENERAL DIMENSIONS.

Capacity with wire feed.....	$\frac{3}{8}$ to 1 inch.
“ without “.....	$\frac{3}{8}$ to 1 7-16 “
Diameter of turret.....	8 “
“ “ holes in turret.....	1 $\frac{1}{4}$ “
Number “ “.....	6
Movement of turret slide.....	5 $\frac{1}{4}$ inches.
Diameter of spindle.....	2 $\frac{1}{2}$ “
Swing over bed.....	14 $\frac{1}{2}$ “
Friction clutch pulleys.....	14x4 “
Speed of countershaft.....	150 rev.
Weight, complete.....	1600 lbs.
Price, with wire feed.....	\$575 00
“ without “.....	425 00
“ B'k Gears, extra.....	75 00
“ Power feed “.....	80 00
“ Friction head, extra.....	150 00

Dimensions and Prices of Screw Machines.

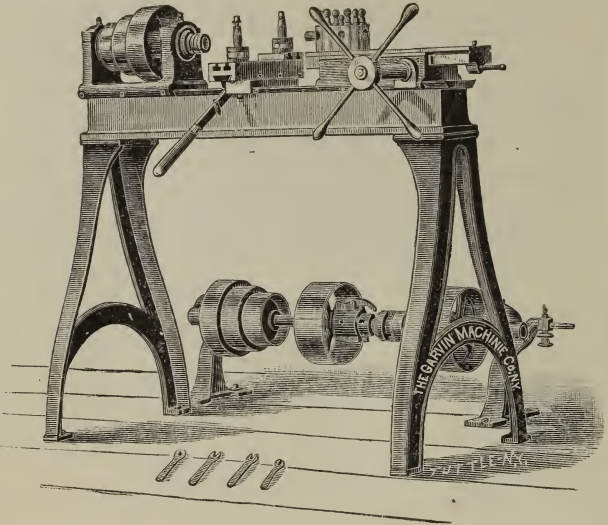
	No. 00.	No. 1.	No. 2.	No. 3.
Capacity, with wire feed.....	0 to $\frac{1}{8}$	$\frac{1}{8}$ to $\frac{1}{2}$	$\frac{1}{4}$ to $\frac{7}{8}$	$\frac{3}{8}$ to 1
“ without “	to $\frac{5}{16}$	to $\frac{3}{4}$	to $1\frac{3}{16}$	to $1\frac{7}{16}$
Diameter of turret.....	$2\frac{7}{8}$	$4\frac{1}{2}$	6	8
“ “ holes in turret.....	$\frac{7}{16}$	$\frac{11}{16}$	1	$1\frac{1}{4}$
Number “ “ “ “	6	6	6	6
Movement of turret slide.....	2	3	$5\frac{3}{4}$	$5\frac{1}{4}$
Diameter of spindle.....	$1\frac{1}{8}$	$1\frac{1}{2}$	$2\frac{1}{8}$	$2\frac{1}{2}$
Swing over bed.....	6	9	$10\frac{1}{2}$	$14\frac{1}{2}$
Friction clutch pulleys.....	$6 \times 1\frac{1}{2}$	8×3	10×4	14×4
Speed of countershaft.....	240	225	200	150
Weight, complete.....	200	425	850	1600
Price with wire feed.....	\$300	\$375	\$450	\$575
“ without “	\$240	\$275	\$350	\$425
Extra for mounting on column.....	\$15			
Back gears, extra.....				\$75
Power feed to turret, extra.....				\$80
Friction head, extra.....				\$150

WORK EXTRACTOR.

Special Screw Machine Attachment.

For manufacturing gas burners and other articles where rapidity in handling is desired, we make an attachment to our Screw Machines by which, when the grip of the chuck is released by the motion of the lever, the piece is automatically knocked out and another can be inserted without stopping the machine.

Price on application.



Monitor Lathes or Turret Head Chucking Machines.

For performing turning operations on metals not requiring the use of oil in cutting, the Monitor Lathes, illustrated above, are especially convenient. Pieces can be chucked, bored and faced much more rapidly and accurately by this means than by any other. The 12 and 16 inch swing machines are built either plain, with common back gears, or with back gears operated by a friction clutch allowing the gears to be instantly thrown in or out of action. This arrangement is of great service where two speeds of cutting are necessary, as the change from one to the other can be made without stopping the machine. The beds are of the open pattern with the turret saddle and cut-off slide, fastened by the usual screw clamps.

DIMENSIONS AND PRICES.

Swing	9 inch.	12½ in.	16 inch.
Diameter of hole in spindle.....	¾	13-11	1 5-16
Diameter of hole in turret.....	11-16	1	1¼
Diameter of turret.....	4½	6	8
Length of feed.....	3	5¾	5¼
Length of bed.....	32	3ft.-2 in.	5½ ft.
Largest diameter of cone.....	6	8½	12 in.
Width of belt.....	2	2½	3¾
Diameter of counter friction pulleys.....	8	10	14
Face	2½	3	4
Speed of countershaft.....	225	200	150
Weight.....	425	850	1400
Price	\$250	\$300	\$375
Price back gear, extra.....		60	75
Price power feed, extra.....			80
Price friction head, extra.....		100	150

Roughing Box Tool.

TAP AND DIE HOLDER.



Fig. 5.

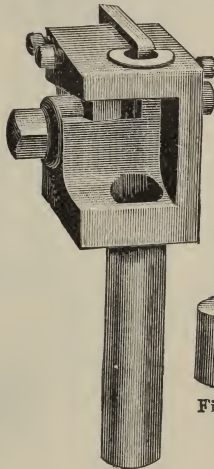


Fig. 1.

TOOL HOLDER.

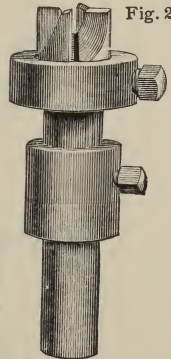


Fig. 4.

Fig. 2



Fig. 3.

Tools used in Turret Head of the Screw Machines.

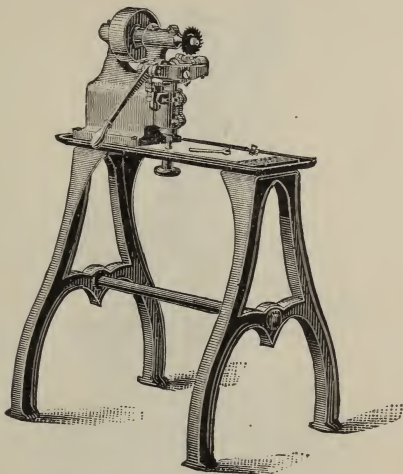
Fig. 1, the box tool, reduces the stock to the head and body size of the screw at one operation; if different diameters are wanted, as in shoulder screws, the hollow mill is used, Fig. 2.

Fig. 4 shows a holder to be used in holding with the bushing (Fig. 3), drills, reamers and other tools, when doing hollow work.

The die holder, Fig. 5, is used in cutting threads, either on the ends or shoulders of the screws, and with the use of the split bushing, (Fig. 3) can be used as a tap holder.

PRICES OF STANDARD SIZES OF SCREW MACHINE TOOLS. SPECIAL SIZES AT EXTRA PRICES.

	No. 00.	No. 1.	No. 2.	No. 3.
Wire feed chucks.....	\$ 2.25	\$ 2.25	\$ 2.50	\$ 3.50
Adjust. box tool with 1 tool holder & back rest	22.00	26.00	35.00	45.00
Roughing box tool.....	10.00	12.00	15.00	18.00
Tool holder.....	2.00	2.00	3.00	4.00
Hollow mills, adjustable, Fig. 2.....	2.00	2.00	2.50	3.00
Tap holder.....	6.00	8.00	9.00	10.00
Die holder.....	8.00	10.00	12.00	14.00
Facing mills.....	3.00	3.00	4.00	5.00
Cutting off tools.....	2.50	2.50	2.50	3.00
Dies.....	1.50	1.75	2.25	3.00
Knurling tool to fit turret.....	8.00	10.00	12.00	15.00
Right and left hand screw chuck.....	14.00	18.00	22.00	28.00
Steel slip jaws plain, per pair.....	2.00	2.00	2.50	3.00

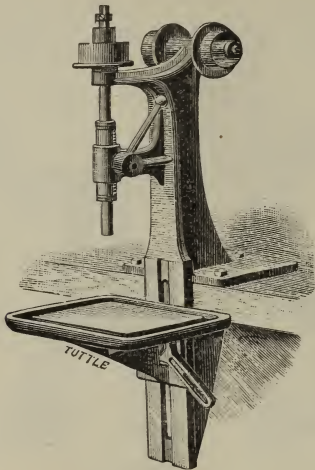


Screw Slotting Machine.

In this machine we have sought to produce an easily and rapidly operated device, which could be sold at a reasonable price. In the construction of the machine, we have aimed at simplicity and convenience of working. The entire operation is a straight downward motion for gripping and slotting the screw, and the upward return motion releases it and leaves the jaws ready for the next. One jaw being adjustable, screws from 3-16 in. to $\frac{1}{2}$ in diameter can be handled without the trouble of changing any of the parts. The bearings of the machine are all adjustable, to compensate for wear, and convenient adjustments are provided for position and depth of slot. This machine, aside from screw slotting, may be applied to work which demands various forms of light milling where extra speed of manipulation is desired. The head is mounted on a planed iron table, around which is a groove for oil and chips. Countershaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS.

Tight and loose pulleys on countershaft.....	8x2 $\frac{1}{2}$ in. face.
Speed of countershaft.....	155 rev.
Weight of machine, complete.....	300 lbs.
Price of machine, complete.....	\$80 00

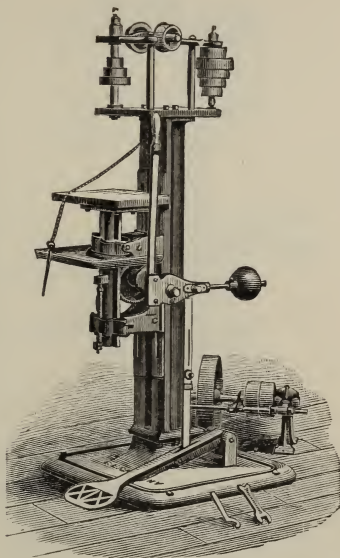


Light Bench or Post Drill.

This drill is intended for electrical and mathematical instrument work and general light manufacturing. The machine, it will be seen, takes up but little space. Photograph will be sent showing the grouping of these drills on all sides of a bench, all driven from one countershaft with friction clutch pulleys. The driving is done through one long belt passing over idler pulleys, and the spindle pulley runs on a hollow stud, which takes the pull of the belt instead of the spindle. The spindle has an adjustable stop on the upper end to regulate the depth of hole. The table is light, has oil groove, and is quickly adjusted and bound by the fixed wrench shown. We make another style of column for the same drill, which is adapted to fastening to the wall or a post.

GENERAL DIMENSIONS.

Diameter of spindle.....	11-16 in.
Travel of spindle.....	3½ in.
Vertical adjustment of table.....	16½ in.
Tight and loose pulleys.....	4½ x 2 in.
Speed of countershaft.....	320 revs.
Largest drill used.....	⅜ in.
Weight with countershaft.....	150 lbs.
Price, including small chuck and countershaft.....	\$50 00

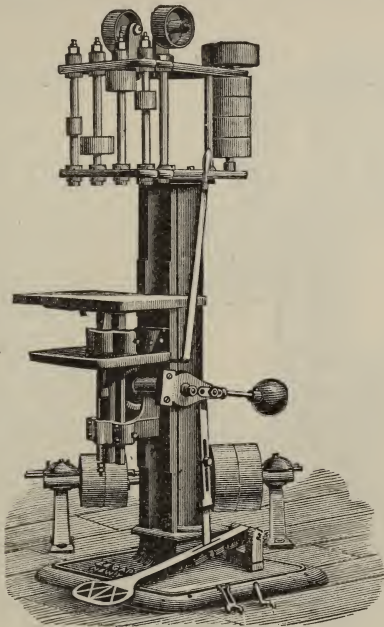


No. 1 Drill Press. With 1 or 2 Spindles.

This machine is designed more for jobbing than for manufacturing, and is fitted up with one or two spindles. Those with two spindles have a cone pulley, allowing two speeds for each spindle. Those fitted up with one spindle have a cone pulley for three speeds. The back shaft has a cone pulley for four speeds. With the above mentioned alterations the press is the same as No. 2 in every particular.

GENERAL DIMENSIONS.

The two-spindle press will drill holes from.....	$\frac{1}{8}$ to $\frac{3}{8}$ in. diam.
The one-spindle press will drill holes from.....	$\frac{1}{8}$ to $\frac{1}{2}$ in. diam.
Size of pulleys on two spindle	$1\frac{1}{2}$, $2\frac{1}{2}$, 2 and 3 in. x 1 in. face.
Size of pulleys on one spindle.....	$2\frac{1}{2}$, $3\frac{1}{2}$ and $4\frac{1}{2}$ in. x 1 in. face.
Size of pulleys on countershaft, tight and loose.....	$6 \times 2\frac{1}{2}$ in.
Number of revolutions per min.....	180
Weight of machine and countershaft	650 lbs.
Price of two-spindle press.....	\$160 00
Price of one-spindle press, as shown in cut.....	150 00



No. 3 Drill Press.

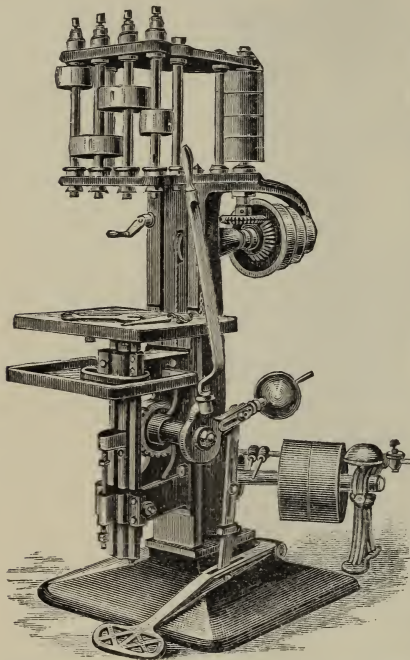
This press is designed to drill holes from 1-16 to $\frac{1}{2}$ in. diameter. It runs noiselessly, and has no gearing except the milled rack and pinion for raising and lowering the table. The spindles are 1-16 in. diameter and hardened and ground, as are also the idler pulley studs. There is a tapered hole in the spindle for receiving the shank of tool which is $\frac{1}{2}$ inch diameter at large end and $2\frac{7}{8}$ ins. deep, with a mortise for drift-key to remove the tools from the spindle. The upright shaft which carries the drum runs in hardened steel bearings, making this a perfect running press in every particular.

When so ordered, we are prepared to furnish an individual lever movement for the spindles in place of the regular table movement. In this case the table is mounted on a plain knee bolted to the face of the column, but adjustable up and down. The countershaft has two sets of tight and loose pulleys and adjustable self-oiling hangers.

GENERAL DIMENSIONS.

Greatest distance from lower end of spindle to table.....	18 in.
Shortest " " " "	4 in.
Length of table.....	22 in.
Width of table.....	14 in.
Distance, center to center of spindles.....	$4\frac{5}{8}$ in.
Pulleys on countershaft, tight and loose.....	8 and 10x3 in. face.

Countershaft should run 120 rev. on the 8 in. pulley.	
Countershaft should run 90 rev. on the 10 in. pulley.	
Weight of press and countershaft.....	850 lbs.
Price, as shown in cut....	\$250 00
" with six spindles....	290 00



No. 4 Drill Press.

This machine is very heavy, and designed for drilling holes ranging from $\frac{1}{4}$ to $\frac{7}{8}$ in. diameter, also for counterboring, reaming, face-milling, or any work that is convenient to be done on an upright drilling machine. The spindles are made of steel $1\frac{5}{8}$ ins. diameter and 20 ins. long, and are held down by adjustable hardened steel steps at top of frame. The lower end has a taper hole to receive the shank of tools $\frac{3}{4}$ in. diameter and 4 ins. deep, with mortise for drift key to remove the tools from the spindle. The spindles run in composition metal boxes fitted up in a very substantial manner, with ample means of adjustment for wear. The table on which the work is

placed has hand and foot levers connected by a milled rack and gear to elevate and lower the table, in connection with adjustable stops to limit the exact motion required. The table guide frame is planed to fit the front of the column by tongue and groove guides, so that the whole table and frame, with all the attachments, can be raised or lowered up or down the column by means of a wire cable with a worm and gear, and can be held in a true position at all points. Countershaft has adjustable self-oiling hangers.

GENERAL DIMENSIONS.

Greatest distance from lower end of spindle to the table.....	20 in.	Pulleys on countershaft, tight and loose.....	12x3 $\frac{1}{2}$ in. face.
Shortest " " " "	6 in.	Rev's of countershaft per min.....	140
Length of table.....	26 in.	Weight of press, with countershaft, about.....	1,200 lbs.
Width "	16 in.	Price with countershaft, as shown in cut.....	\$350 00
Length of Spindle.....	20 in.	Price with six spindles....	400 00
Diameter "	1 5-16 in.		
Distance between spindles.....	5 in.		

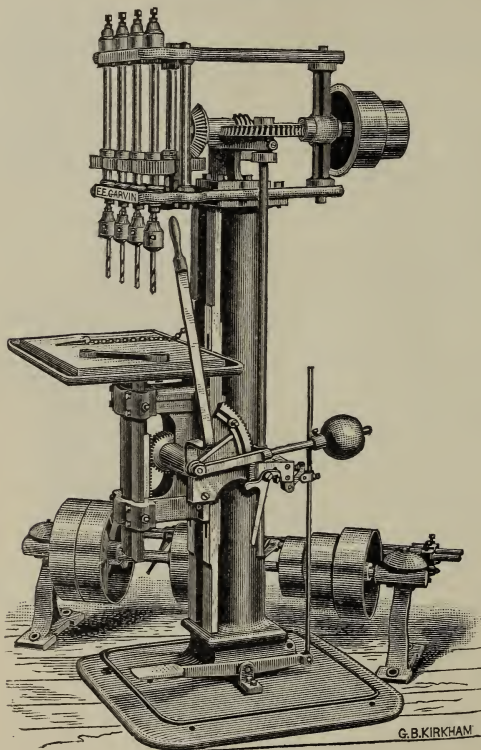
Drill Presses.

	Bench or Post.	No. 1.	No. 2.	No. 3.	No. 4.
Capacity.....	0 to $\frac{3}{8}$	$\frac{1}{16}$ to $\frac{1}{2}$	$\frac{1}{16}$ to $\frac{3}{8}$	$\frac{1}{16}$ to $\frac{1}{2}$	$\frac{1}{4}$ to $\frac{3}{8}$
Greatest dist. bet. spindle & Table...	20	18 $\frac{1}{2}$	19	18	20
Least " " " " " ...	1	4	4	4	6
Length of feed.....	3 $\frac{1}{2}$	4	4	3 $\frac{1}{2}$	4
Diameter of spindle.....	$\frac{5}{8}$	$\frac{15}{16}$	1	1 $\frac{1}{4}$	1 $\frac{5}{16}$
Length of table.....	7	15	18	22	26
Width " "	7	10	12	14	16
Distance bet. centers of spindle.		4 $\frac{3}{4}$	4 $\frac{3}{4}$	4 $\frac{5}{8}$	5
Countershaft pulleys.....	4 $\frac{1}{2}$ x2	6x2 $\frac{1}{2}$	6&8x2 $\frac{1}{2}$	8 & 10x3	12x3 $\frac{1}{2}$
Speed of countershaft, [fast]....	320	180	220	120	140
" " " [slow] ...			165	90	
Weight, complete.....	150	650	700	850	1200
Price, as shown.....	\$50	\$150	\$175	\$250	\$350
" with two spindles.....		\$160			
" " four "			\$190		
" " six "				\$290	\$400

Cam Groove Miller.

For milling cam grooves on flat pieces, such as the cam on a sewing machine needle bar, there are two slides one carried on the other, each being controlled by a cam, one of which gives the vertical and the other the horizontal motion and working in combination give a uniform feed throughout and produces a groove in which the roll will fill without shake in any part. The two large cams, besides giving a uniform feed, afford a very much larger wearing surface than a groove which is a fac simile of the one to be cut, and the cams having also no sharp corners to wear off will last much longer and produce better work. The cutters are held in a spring chuck and the cutter head is adjustable for depth of cut. An automatic stop motion is provided to stop the machine at the end of the cut,

Price and Photo on application



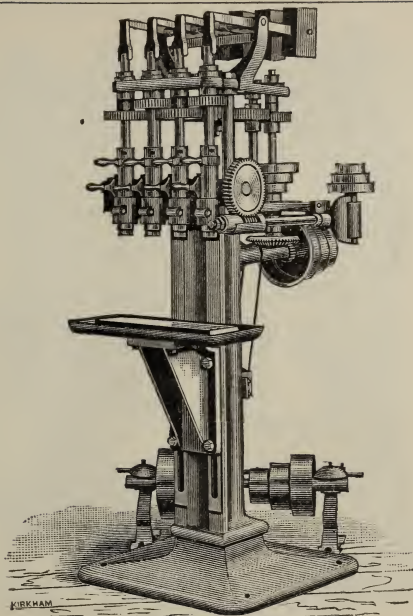
Nos. 3 and 4 Automatic Feed Drill Press.

These machines are the result of the application of gearing to the spindles and an automatic vertical feed to the tables of the regular drill presses of these two sizes.

The machines are accordingly more powerful and positive in their action, and on certain classes of manufacturing, where uniformity of work is the important point, are an economical tool. There is an automatic trip for feed, adjustable to any point, and can be readily disengaged by hand.

The lever feed can be employed, when desired, without any change of parts. The capacity of the presses is precisely the same as the regular No. 3 and No. 4 Drill Press.

Prices on application.

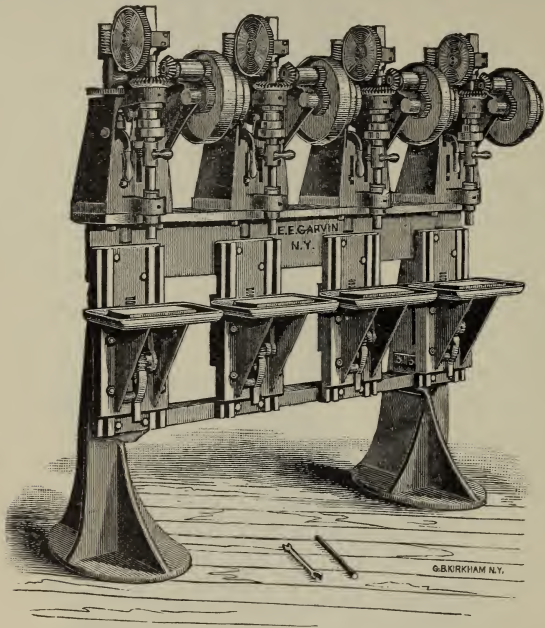


Independent 4-Spindle Drill Press.

This is a most convenient press for many kinds of work. Each spindle runs in a long sleeve which holds a rack, and is fed down by a pinion on the clutchshaft which runs behind the spindles. There is a handle on each spindle shell to move it quickly, and the power feed is thrown in by engaging the fine clutch on the rack pinion, which is done by means of the handles seen at the side of each spindle. There is an adjustable stop on the spindle sleeve which throws out the clutch, and the spindle is then raised by the balance weight shown over the top plate of the machine. Each spindle remains in its highest position when not in use, so that a hole may be drilled with one spindle and counterbored with another without interference, or four holes, all of different sizes and depths, may be drilled at one time, each to its set depth. The spindles are driven by gearing, and the feed through worm gearing running in oil, thus making a positive and powerful machine. There is a small rotary oil pump on the back of the column, driven from the cone shaft, the supply from which can be led up to the drills by suitable tubing. The table is adjustable on the column, and is 6x21 ins., with a large oil groove all around, which can be connected with the rotary pump. There are three changes of speed and feed. The lower bearings for the spindle sleeves are split for taking up the wear. The countershaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS.

Distance from center of spindle to face of column.....	.6 in.	Countershaft pulleys.....	12x3 in.
Length of feed.....	.3 in.	Greatest distance from lower end of spindle to table.....	.20 in.
Diameter of spindle.....	1 $\frac{5}{8}$ in.	Shortest " ".....	.6 in.
Width of belt.....	.3 in.	Weight.....	1,200 lbs.
Price on application.			



Automatic Drill Press.

The cut shows four of these presses mounted together. Each one is, in fact, a complete, perfectly independent drill press, so that two or three may be set for special jobs, and the remaining one used for general work. There is automatic feed and trip and handle for quick movement of the spindle by hand. The spindle is $1\frac{5}{16}$ in. diameter, balanced, and has a movement of $3\frac{1}{4}$ ins. The machine will drill holes up to 1 in. diameter, and do such other work as ordinarily comes within the province of a drill press. The feed is by rack and pinion, the thrust being taken on a hardened step in the end of the spindle. The tables are independently adjustable, and raised and lowered by rack and pinion. Provision is made to catch oil as shown. These presses are mounted singly on a column, or upon a rigid framework in groups of two, three or four, as certain manufacturing operations demand. The cone has three speeds for two in. belt. There are three changes of feed.

GENERAL DIMENSIONS.

Length of feed.....	$3\frac{1}{4}$ in.	Speed of countershaft.....	200 revs.
Tight and loose pulleys.....	$8 \times 2\frac{1}{2}$ in.	Weight.....	3,200 lbs.
Price on application.			

Six Spindle Automatic Drill Press.

The spindles are driven from a floor countershaft by belts, which run to the spindle over idlers. The driving pulleys are attached to the countershaft by clutches, which allow the spindles to be run independent of each other. A lever conveniently placed operates the clutch, and a handle is provided for quick return of the spindle. The machine has two changes of speed and three changes of feed.

Weight, about.....4,200 lbs.

Adjustable Spindle Drill Press.

This machine is mounted on one of our regular No. 2 Drill Press columns with similar lower works, and fitted with three spindles set in line and operated at the same time. Holes may be drilled up to $\frac{3}{8}$ in. diameter. The outside spindle frames are adjustable independently by means of screws and hand wheels, and will drill from 6 to 8 in. from center hole. The center spindle is stationary. Table is long enough to hold work when spindles are 3 ft. apart. A belt tightener accommodates the belt to its different positions.

Weight, about.....750 lbs.

Nine Spindle Drill Press.

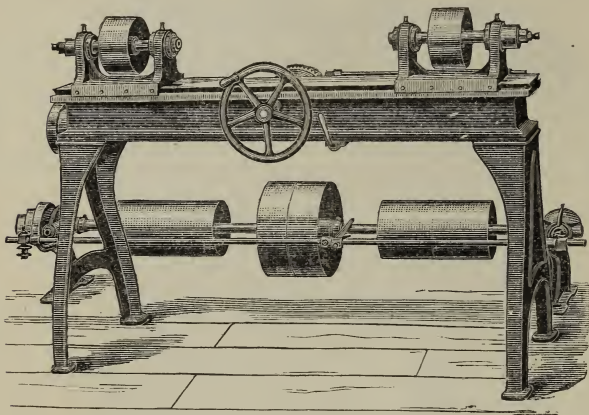
This is a special multiple drill designed for drilling holes radiating from a common center, such as certain kinds of gasoline burners, sprinklers, electric commutators, etc. The rows of holes are drilled nine holes at a time, and the piece is then indexed for nine holes more. The number of holes to be drilled at a time can be changed according to the number of holes in the complete circle. The spindle holding the work can be raised or lowered, so that a number of rows can be drilled at various distances apart. The spindles are all fed in and out together by the to and fro motion of a lever on top. The spindles are driven by friction, and therefore run noiselessly and admit of high speed.

Diameter of largest drill can use, $\frac{1}{8}$ inch.

Ten Spindle Drill Press.

This is a heavy machine for drilling a series of holes in a row at one time. The spindles can be adjusted relatively to each other, and are fed down together and tripped automatically. The table is adjustable on the column.

Prices on application.



Two Head Drill Lathe.

This is a special form of drill press, designed particularly for manufacturing operations where it is desired to drill holes in the opposite ends or sides of a piece of work, and have the holes in line, such as the shaft hole in a sewing machine arm, etc.

The work is held in a fixture between the heads and the holes drilled, reamed or counterbored with the certainty that they will be in line and the further advantage of drilling two holes at one time.

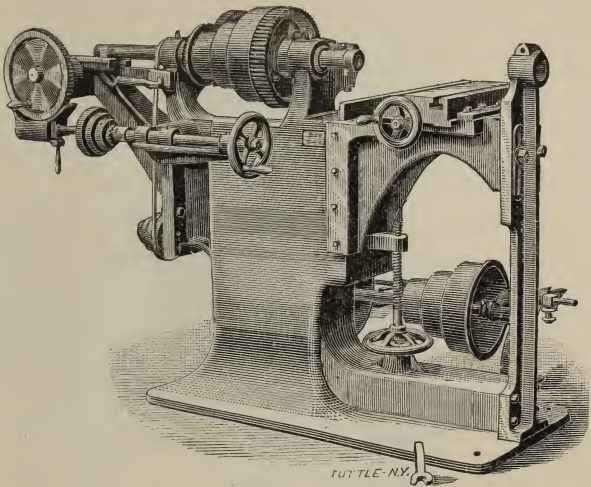
This style of drill press is also most convenient for drilling holes in ends of long rods, frames, legs, etc., which cannot be handled to advantage in an ordinary drill press.

The heads are fed up simultaneously and the power feed is automatically tripped by an adjustable stop, so that the holes will always be the same depth. Hand feed, operated by the large wheel in front, is also provided for quick return and rapid handling of work. The spindles run in composition taper boxes, adjustable for wear, and sliding surfaces are scraped to a perfect bearing.

GENERAL DIMENSIONS.

Height of center of spindle.....	4 13-16 in.
Extreme distance between heads.....	.36 in.
Diameter of largest hole can drill.....	7-8 in.

Price on application.



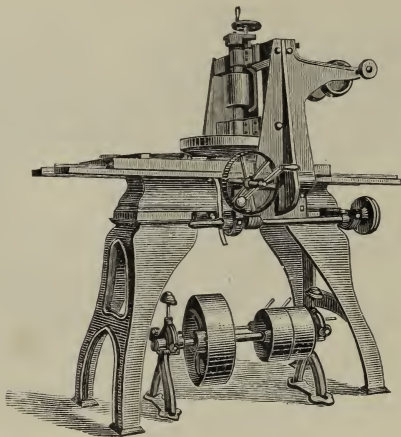
Boring Machine.

This machine is intended for every kind of general work that comes within its range. The cone is $11\frac{1}{2}$ ins. diameter for $3\frac{1}{2}$ in. belt, and is back geared 8 to 1. The spindle driving the boring bar is 2 ins. in diameter, sliding in a 3 in. steel sleeve, and is fed by rack and pinion at the back end. The feed is driven through a large worm gear and worm running in oil, which latter can be dropped out of the gear, and spindle run back quickly by means of the handle on the face of the worm gear. The feed drives through a clutch carried on the worm shaft, which is brought out to the front of the machine and provided with a hand wheel, so that, throwing the cone pulley clutch out of gear, a very fine hand feed can be given to the spindle, useful in facing off. The table is 8 ins. wide on top and 18 ins. long, with hand wheel and screw for horizontal adjustment, and has two T slots running the whole length. The knee adjusts vertically upon the face of the column and the frame that forms the outside support for the boring bar, making a very solid support for the work. The driving cone has three grades, $3\frac{3}{4}$ in. face, and there are also three changes of feed. We make this machine with a table 12 ins. wide on top and 24 ins long.

GENERAL DIMENSIONS.

Length of feed.....12 in.
 Distance from center of spindle
 to top of table in lowest po-
 sition.....14 in.

Tight and loose pulleys.....14x4 in.
 Speed of countershaft.....120 rev.
 Weight.....2,000 lbs.
 Price.....\$600 00

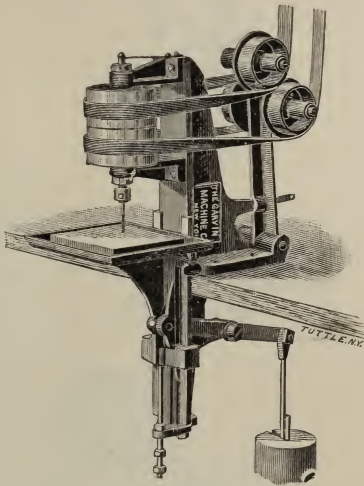


Wood Planer.

This machine is designed for dressing wood for mounting ELECTROTYPERS' and STEREOTYPERS' PLATES. The machine is all metal, and is very substantially made, and has both hand and power feed. The spindle and cutterhead are similar to the Daniels Planer in their operation. The head that carries the cutter is a flanged disc, running without noise or blowing. The spindle has a collar and step on the top end to prevent friction and grinding, as is the case in fast running spindles that have shoulders on both the upper and lower boxes. The sliding table is $1\frac{1}{2}$ inches thick, and on the under sides are guides planed to fit the bed, while the top side takes the spur jaws that hold the work. The edge of the table has a gib piece fitted to it, which prevents the tipping up and side wise motion of the table when run far out. A stop screw is provided on the top of the spindle slide for convenience in resetting the cutter head. In setting up this machine, care should be taken to have an equal bearing on all four feet—a blow with a wooden mallet over the bearing parts will best indicate this—and when found correct, secure the feet firmly to the floor. It is important to have the cutters that are to be used together, of exactly the same weight. The countershaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS.

Will plane the smallest block.	
" " width.....	16 in.
" " length.....	30 in.
Length of sliding table.....	42 in.
Width " " ".....	$16\frac{1}{4}$ in.
Diameter of cutter head.....	18 in.
Size of the machine on the floor.....	5x3 ft.
Size of tight and loose pulleys on countershaft.....	6x4 in. face.
Number of turns countershaft should run per minute.....	400
Weight of machine and countershaft.....	1100 lbs.
Price, as shown in cut.....	\$375 00



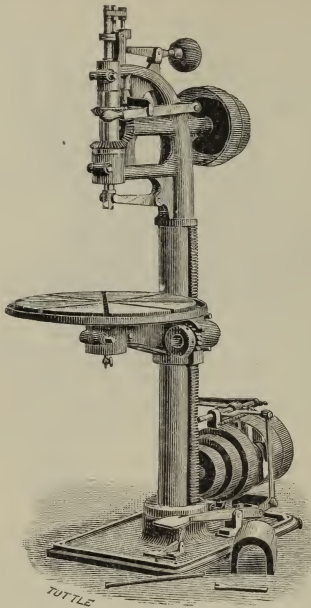
Nos. 0 and 1 Vertical Tapping Machines arranged for Bench.

Manufacturers of articles requiring the tapping of small holes will appreciate this tool, which has been designed to combine strength with lightness and handiness. The spindle is driven directly by a continuous belt and a friction disc between the two pulleys, which connects the spindle with either at will. This disc has but a small vertical motion, insuring quick reversal of the tap, small wear, and perfect noiselessness. The table is counterbalanced by a weight, and the arrangement is such, that it allows the full use of both hands in holding the work; and uniform depth of tapping is provided for by an adjustable stop screw, limiting the motion of the table in either direction.

GENERAL DIMENSIONS.

	No. 0.	No. 1.
Largest hole tapped.....	1/8 in.	1/4 in.
Depth of tapping.....	1 in.	2 in.
Greatest distance between chuck and table.....	5 in.	6 in.
Adjustment of table.....	5 in.	6 in.
Dimensions of table.....	5x4 1/2 in.	6x7 in.
Tight and loose pulleys.....	4 1/2 x 2 in.	6x2 in.
Speed of countershaft, revolutions per minute.....	220	200
Weight, complete, lbs.....	80	130
Price.....	\$90.00	\$100.00
Price, mounted on a column.....	\$100.00	\$110.00

Photographs on application.



No. 2 Automatic Tapper.—(Patented.)

This machine is adapted for tapping holes rapidly, squarely, and to a uniform depth in work of any size, large or small. The driving clutch is thrown into gear and the tap started by the lever shown on the side of the machine, when the tapping proceeds, trips and reverses automatically. When the stop is not set the catch on the top of the machine is readily pushed off by hand, or the tap may be stopped instantly by tripping the treadle on the base. The table has T slots for holding down work, and has an oil groove around the rim with reservoir in the center. The table can turn on its center, and also swing around on the column. The spindle is balanced by a weight inside the column, and is provided with a slip chuck for holding taps below $\frac{1}{4}$ inch. This chuck can be set for different degrees of resistance, and when the tapping becomes greater, from careless drilling, than the tap can safely stand, the chuck will slip around in its spindle and avoid breaking the tap. The driving cone has three steps for $2\frac{1}{2}$ inch belt.

GENERAL DIMENSIONS.

Diameter of spindle.....1 5-16 in.
 Largest size of hole that can
 be tapped..... $\frac{1}{2}$ in.
 Motion of spindle.....4 in.
 Diameter of table.....24 in.
 Adjustment up and down on
 column.....28 in

Tight and loose pulleys.... .10x3 $\frac{1}{2}$ in.
 Speed of countershaft.....135 revs.
 Weight.....675 lbs.

Price, including slip

attachment....\$250 00

No. 3 Automatic Tapper.

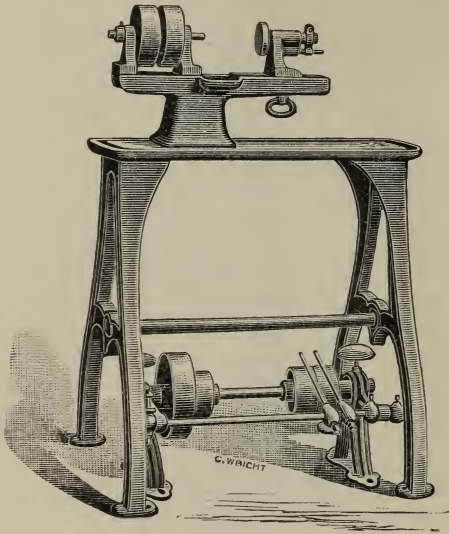
PATENTED.

This is a heavy machine, designed particularly for engine and pump cylinder work, but also for work beyond the capacity of the No. 2 machine. The table is large and has T slots in both directions for holding work. The adjustment on the column is by cable wound by a worm and gear operated by a crank at the back of the column. The cone has three speeds for a 3 in. belt and is geared over 4 to 1. The spindle is balanced by a weight inside the column. The driving clutch is thrown into gear by the lever on the side of the head, and the tap started by the lever connected to the end of the spindle. Considerable power is required to start in a large tap, and this handle gives a powerful leverage for the purpose. The stud on which the toe of the lever rocks is adjustable for different lengths of movement of the spindle. There is automatic trip and reverse as in the No. 2 machine. The bevel gears in front are covered to prevent accidents. A special chuck for holding taps goes with the machine. This chuck has two adjustable V jaws made to a particular angle and stepped in their length. The lower parts of the jaws grip the round shank of the tap and hold it central, and the upper parts close in around the square through which the tap is driven.

GENERAL DIMENSIONS.

Largest tap used	1 in.
Movement of spindle.....	4 in.
Distance from center of spindle to face of column.....	8¾ in.
Diameter of spindle	1¾ in.
Adjustment of table.....	22 in.
Tight and loose pulleys	12x3 in.
Speed of countershaft.....	225 rev.
Weight.....	1,150 lbs.
Price.....	400 00

Photograph on application.

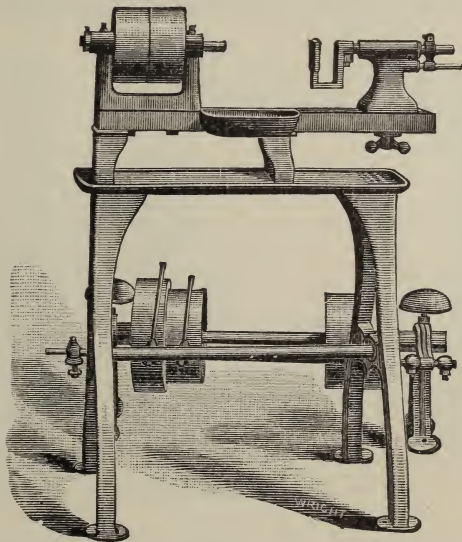


No. 1 Tapping Machine.

This machine is mounted on a planed iron table with a groove around the edge to catch the oil and chips. There is also an oil pan cast as part of the bed, directly under the tap. A spring chuck is furnished for holding taps. This machine will tap holes ranging from 1-16 to 3-16 in. diameter, and is fitted with adjustable collar same as described in No. 2 Tapping Machine. For high speed tapping we make this machine with friction clutch between the pulleys. Counter-shaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS,

Greatest distance between chuck and face for work.....	7 $\frac{3}{4}$ in.
Tight and loose pulleys.....	6x2 $\frac{1}{2}$ in. face.
Speed of countershaft.....	.225 rev.
Weight, complete.....	.260 lbs.
Price.....	\$.60 00



No. 2 Tapping Machine.

This machine is similar in general design to No. 1 machine, but constructed sufficiently heavy to tap holes ranging from $\frac{3}{16}$ to $\frac{1}{2}$ in. diameter. We furnish with this machine a chuck that will hold taps from $\frac{1}{8}$ to $\frac{5}{8}$ in. diameter. An adjustable collar is fitted to the front end of the spindle, which adjusts the clutch and allows shallow holes to be tapped. Countershaft hangers adjustable and self-oiling.

We make a No. 3 machine that is back geared to tap $\frac{3}{4}$ in. standard, mounted on a pan and legs similar to our No. 2 Screw machine.

GENERAL DIMENSIONS.

Greatest distance between chuck and face for work.....	10 $\frac{1}{8}$ in.
Tight and loose pulleys on countershaft ..	10x3 in.
Speed of countershaft.....	150 rev.
Weight of machine as shown in cut... ..	350 lbs.
Price of machine as shown in cut.....	\$80 00
Price of No. 3 machine.....	200 00

Photo on application.

Table of Dimensions and Prices of Tapping Machines.

	VERTICAL				HORIZONTAL		
	No. 0	No. 1	No. 2	No. 3	No. 1	No. 2	No. 3
Largest hole tapped.....	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{3}{4}$
Depth of Tapping.....	1	2	4	$4\frac{3}{4}$	$1\frac{1}{2}$	$2\frac{1}{2}$	3
Greatest dist. bet. chuck and table	6	6	28	$25\frac{1}{2}$	$7\frac{3}{4}$	$10\frac{7}{8}$	8
Adjustment of table.....	4	6	28	22	8	12	8
Dimensions of table.....	$4\frac{1}{2} \times 5$	6×7	24 di.	15×24	$1\frac{1}{2} \times 2$	2×3	6×6
Tight and loose pulleys.....	6×2	6×2	$16 \times 3\frac{1}{4}$	12×3	$6 \times 2\frac{1}{2}$	10×3	8×3
Speed of countershaft, rev.....	240	200	135	225	225	150	350
Weight, lbs.....	75	130	675	1150	260	350	540
Price....	\$90	\$100	\$250	\$400	\$60	\$80	\$200
Price, mounted on a column.....	100	110					

Small Size Slotting Machine.

We are arranging this machine with special reference to the requirements of die makers. It is so arranged as to give the proper clearance to blanking dies, and has easy adjustment of both travers and in and out screws, which are graduated to read in thousandths. The machine is 2 inch stroke (which is adjustable) and can handle and finish a die 4 inches wide and long, or under, at one setting. Weight of machine about 350 lbs., complete.

Price and photograph on application.

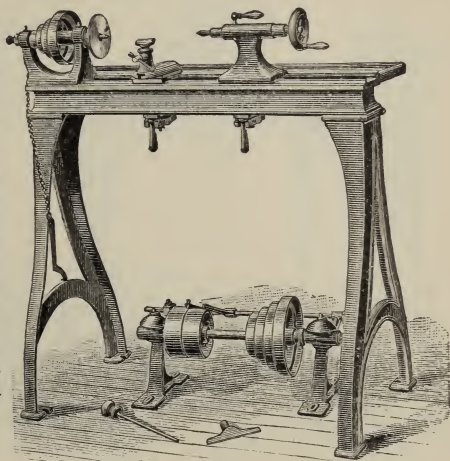
Face Grinding Machine.

A machine designed especially for grinding metal saws on the sides giving them the proper clearance, and bringing them to exact thickness. Machine is arranged to use a coarse and fine wheel, both wheels having screw adjustment reading to the thousandths of an inch, and are arranged for using water, with pump complete, for returning water to overhead reservoir. A peculiar feature of this machine is the arrangement for giving different lengths of feed, and bringing the work first to the roughing wheel and then to the finishing wheel, which is done at one motion. Weight of machine about 1200 lbs.

Price and photograph on application.

10-Inch Hand Lathe.—(Hollow Spindle)

This is similar to the 12-in. hand lathe in design and construction. The spindle is hardened and ground, with hardened thrust screw and washer, runs very light, and is adapted for the finest hand work. New patterns have recently been made and a better distribution of metal effected. A convenient shelf for tools is fastened to the bed on a level with the shears.

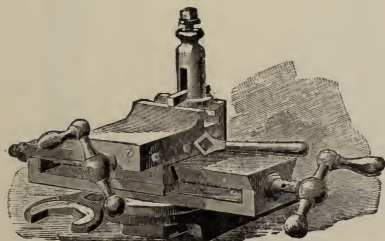


GENERAL DIMENSIONS.

Hole through spindle $\frac{3}{8}$ in. diam.
 Length of bed.....40 in.
 Distance from floor to center of spindle 14 in.
 Distance between centers ... 24 in.
 Actual swing of lathe $10\frac{1}{2}$ in.

Tight and loose pulleys on countershaft 6×2 in.
 Speed of countershaft.....235 revs.
 Weight, complete.... 300 lbs.
 Price on high legs, with shelf, \$60 00
 " on low legs, for bench, 55 00
 " lever attachment..... \$10 00

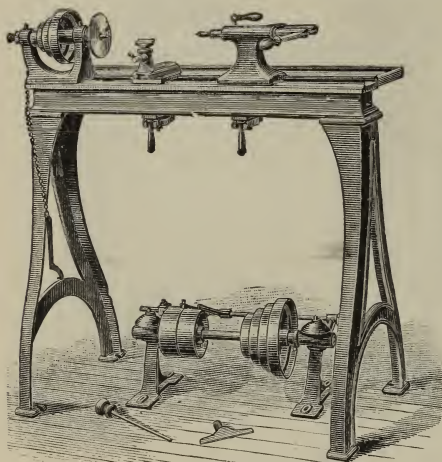
Slide Rests.



We make three sizes of this rest one for 15-in., 12-in. and 10-in. hand lathes. The screws are steel, and the sliding surfaces are scraped to bearing. There is a quickly adjusted elevated arrangement for the tool post, which, together with its other advantages, makes this a first-class tool in every respect.

For 15-in. Lathe. Feeds Lengthwise, 8 in., Crossfeed, 3 in.....	Price	\$45 00
" 12 " " " " 8 " " 2 $\frac{3}{4}$ "	"	40 00
" 10 " " " " 7 " " 1 $\frac{3}{8}$ "	"	25 00

10 In. Hand Lathe.



This cut shows the 10 in. Hand Lathe arranged with the fixed lever.

Where the lathes are to be in constant use for drilling, reaming, counter-boring or similar operations, making a lever attachment desirable, we furnish a fixed lever to the tail spindle as shown in cut above.

Price as shown,

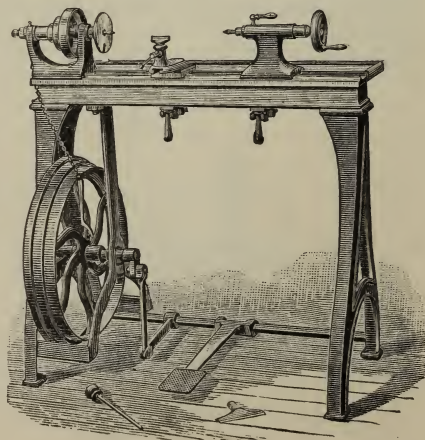
10 in. fixed lever..	\$55.00
12 in. " " ..	\$70.00
15 in. " " ..	\$90.00

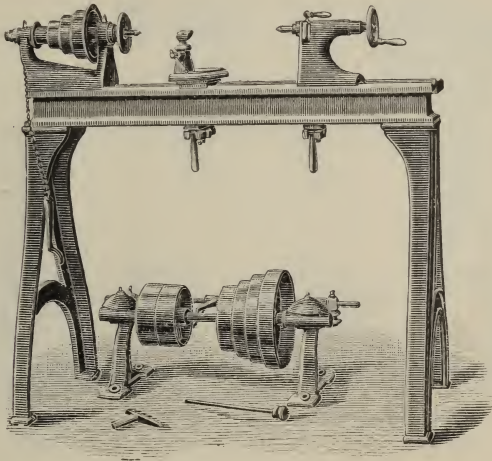
Hand Lathe, arranged with Foot Motion.

The lathe proper is identical with the 10 in. and 12 in. Hand Lathe. The treadle is adjustable along the lathe, and the hook connections prevent any injury from getting the foot underneath the treadle. The space underneath the bed, it will be noticed, is free of all obstructions beyond the pulley.

Price, as shown.

10 in. swing.....	\$70.00
12 " " ..	90.00





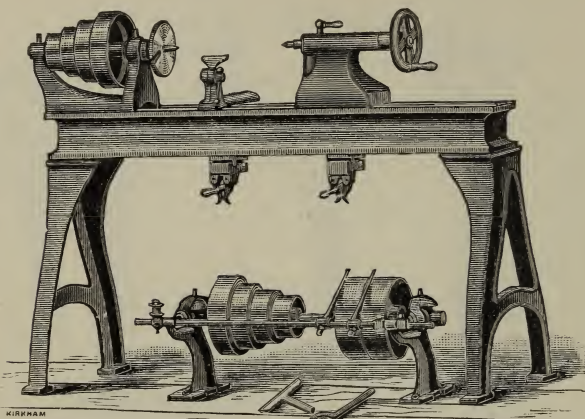
12-Inch Hand Lathe.—(Hollow Spindle.)

The machine represented above is thoroughly built in every respect, with steel spindles hardened and ground, the head spindle being below, with 17-32 in hole through it. Both bearings run in composition metal boxes, having adjustments for wear, and so constructed as to always retain the spindle in a central position. The thrust of the spindle is taken by a hardened tool steel step screw and washer. Both cones are of iron, and, as is the case with all our hand lathes, the spindle cone is turned inside in order to perfectly balance the running gear. A very convenient arrangement for the reception of tools and pieces of work is a wooden shelf 9 inches wide, which runs the whole length of the lathe, supported by iron brackets attached to the bed. We furnish this machine, when ordered, with back gears, also with a slide rest and a new lever attachment for tail spindles; countershaft hangers being adjustable and self-oiling.

GENERAL DIMENSIONS.

Length of bed..... 4 ft.
 Distance from floor to center of
 spindle..... 45 in.
 Distance between centers..... 26 in.
 Actual swing of lathe..... 13 in.

Tight and loose pulleys on coun-
 tershaft..... 8x2½ in.
 Speed of countershaft..... 220 rev.
 Weight, complete... 430 lbs.
 Price of lathe..... \$75 00
 " lever attachment.. 10 00



15-Inch Hand Lathe.—(Hollow Spindle.)

This lathe is designed with a view of obtaining ample strength and stiffness. The spindles are both of steel, and the headspindle has an $\frac{1}{8}$ in. hole its entire length. Both bearings run in composition metal boxes, and have adjustments for wear. The front bearing is $3\frac{3}{8}$ ins. long and $1\frac{1}{4}$ in. diameter. The cones are both of iron, with four changes of speed, of extra large diameter, and with a face for a $2\frac{1}{2}$ in. belt. The spindle cone is turned inside and out, to insure smooth running at high rates of speed. The tail stock and tool rest are held to the bed by means of cam binders, which are readily accessible from front of lathe, and are provided with spring clamps to hold the lever up when binder is slackened. The tail spindle has a 5 in. movement and is securely held in position by clamping lever upon the split bearing. Countershaft hangers adjustable and self-oiling.

GENERAL DIMENSIONS.

Length of bed	5 ft.
“ between centers.....	.30 in.
Distance from floor to center of spindle.....	42 in.
Actual swing of lathe.....	15½ in.
Tight and loose pulleys on countershaft.....	10x8 in. face.
Speed of countershaft.....	185 rev.
Weight, complete	645 lbs.
Price, as shown in cut.....	\$100 00

11 and 13 Inch Hand Lathes.

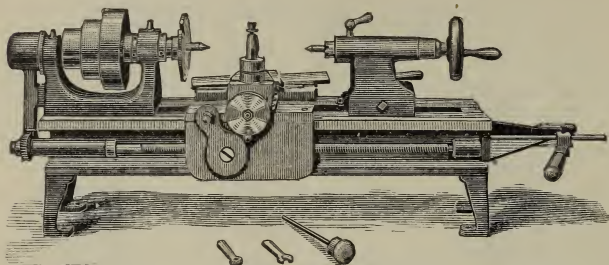
In general design, these lathes follow very closely those illustrated in the preceding pages. The boxes are of the usual cap form with the shoulder bearings adjustable for wear. The spindle is of large diameter, hollow. The cone is turned inside and out to insure correct balance. The tail stock and tool rest are solidly bound to the bed by cam binders. The tail stock is of substantial design, and the spindle is moved either by screw or lever, as may be ordered.

GENERAL DIMENSIONS.

Length of bed.....	40 in.	48 in.
Length between centers.....	24 in.	26 in.
Distance from floor to center of spindle.....	44 in.	45 in.
Actual swing of lathe.....	11 in.	12 in.
T. & L. pulleys on countershaft.....	6x2	8x2½
Speed of countershaft.....	235	220
Weight, complete.....	300	430
Price.....	\$60	\$75
Price with lever tail stock.....	\$70	\$85

Dimensions and Prices of Hand Lathes.

	10 inch Swing.	11 inch Swing.	12 inch Swing.	13 inch Swing.	15 inch Swing.
Length of bed,	40 in.	40 in.	48 in.	48 in.	5 ft.
Distance between centers,	24 in.	24 in.	26 in.	26 in.	30 in.
Actual swing of lathe,	10½ in.	11 in.	13 in.	13 in.	15½ in.
Hole through spindle,	¾ in.	¾ in.	17/32	17/32	11/16
T. & L. pulleys on countershaft,	6x2	6x2	8x2½	8x2½	10x3
Speed of countershaft,	235	235	220	220	185
Weight, complete,	300	300	430	430	645
Price,	\$60	\$60	\$75	\$75	\$100
Price with lever attachment,	\$70	\$70	\$85	\$85	\$115



Turning Lathe.

This is a small, well made tool, arranged with quick motion for carriage and an automatic stop motion to adapt it more particularly, to manufacturing purposes. The cross feed screw is graduated to read in thousands, and the tool post has two inclined collars which can be turned on one another to raise the tool. The feed is by screw driven by worm gear at the end. This worm gear can be taken off and others put on to get changes of feed. The bracket carrying the worm shaft swings from the center of the spindle and can be bound in any position. The handle for clamping the nut on the feed screw is on the front of the apron. When the nut is unclamped, the carriage can be quickly moved by the lever and connecting rod shown at the end of the bed. An adjustable stop is provided on the front of the tail stock, so that the carriage can be brought back to exactly the same place. The connecting rod is adjustably connected with the lever, so that the carriage can be handled at any part of the bed. The lever gives a movement of 8 inches. The automatic stop motion is connected with the countershaft, and can be set for any desired length, and with the carriage at any part of the bed. The tail stock is made with set-over for taper work. A taper attachment is made to go on these lathes, which can be set to 30° and will take a length of 8 inches. We make the lathe with short legs to set on the bench, or in a pan on high legs similar to our No. 1 Screw Machine.

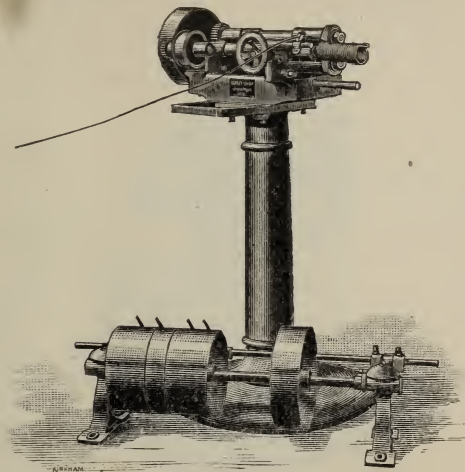
Swing of lathe.....	9 inches.
Price.....	\$170 00
Price, with taper attachment.....	190 00

Six Automatic Turning Lathes.

This is a very compact arrangement of six lathes for manufacturing purposes, yet providing all the facility of access practically required. The lathes are manipulated from the tail stock end and are all independent. The work is put in and the individual lathe started by throwing in the clutch on the spindle pulley, and clamping the nut on the feed screw, which has three speeds. The carriage will then feed until it strikes an adjustable stop and continuing, pushes out the spindle pulley clutch and brings the lathe to rest. The work is then taken out, the carriage pulled back and another piece put in, and this is repeated on each lathe while the others are running.

Swing of lathe	8 inches.
Length it will take in between centers.....	19 "
Floor space.....	3½x4 ft.

Price and photograph on application.

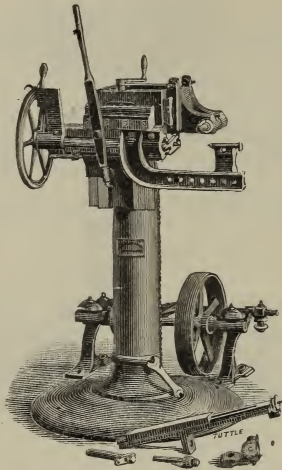


Spring Coiling Machine.

The above cut represents a machining for bending wire into a continuous coil. It is designed to make springs, either open or closed, from one-half to two and one-half inches in diameter, and will wind to No. 6 tempered wire. In the cut a wire is shown leading to the machine from the left and issuing in a coil at the right. The wire passes through an adjustable guide, and then—accordingly as the spring is to be wound right or left—under or over the arbor on which it is bent. It is held to the arbor by two grooved rolls at the back. Both the arbor and the rolls are driven by power. We also furnish fixtures for cutting off the springs to exact lengths and for looping the ends of tension springs. One set of rolls and one arbor, with a full set of change feed gears, accompany a complete machine.

Table of Dimensions and Prices of Spring Coilers.

	No. 1.	No. 2.	No. 3.	No. 4.
Largest diameter of spring.....	1½ in.	3 in.	4 in.	4 in.
Smallest " " "	¼ in.	⅜ in.	¾ in.	2½ in.
Largest wire will use.....Gauge..	No. 12.	No. 6.	No. 4.	½ in.
Smallest " " "	No. 22.	No. 14.	No. 18.	⅜ in.
Price	\$175	\$250	\$350	\$475



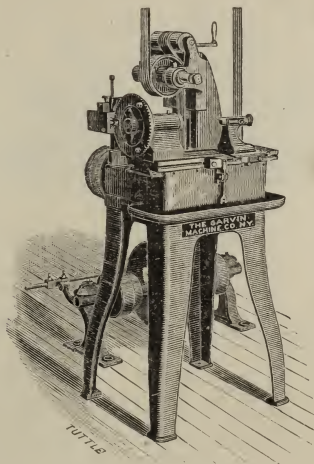
No. 1 Gear Cutter.

This handy little machine is intended for rapid and convenient cutting of light gears, ratchets, etc., used in telegraphic and mathematical instruments, etc. It will swing a diameter of 6 inches on centers and about 12 inches when the arm which carries the tail center is taken off. The slide has a movement of $5\frac{1}{4}$ inches between two adjustable stops. There is also adjustment of cutter head of 3 inches allowing the use of finishing and roughing cutter side by side on the arbor, against one stop for roughing cutter, and moved against the other stop for position of finishing cutter. There is also ample vertical screw adjustment for depths of cut, and to accommodate varying sizes of work. There is a large box formed in the top of the machine convenient for holding work, cutters, etc. The cutter spindle can be nicely adjusted to bring the cutter central, and there is also screw adjustment for depth of cut. A backing up support for the work is furnished, which prevents chattering and secures smooth cuts in thin flexible gears. The indexing is done by means of a pawl acting on a large ratchet wheel between the two adjustable stops. A rack cutting attachment, with micrometer adjustment in thousandths of an inch, is shown at the base of the machine in the cut. There will also be seen a bevel-gear fixture, with the necessary adjustments for rolling, in cutting the gear to a center. A small swivel vise is also made to go with the machine. Countershaft hangers are adjustable and self-oiling.

GENERAL DIMENSIONS.

Tight and loose pulleys on countershaft..... $4\frac{1}{2}$ x2 in. face
 Speed of countershaft.....400 rev.
 Weight of machine complete...300 lbs.

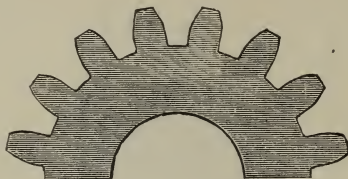
Price of swivel vise....	\$10 00
“ rack cutting attachment...	30 00
“ bevel gear “	10 00
“ Machine.....	\$200 00



No. 2 Gear Cutter.

This is a carefully designed machine and embodies a number of important features. The movements of the machine are entirely automatic, and after the machine is adjusted the various steps necessary to the cutting are automatically repeated until the gear is finished when the machine stops automatically. It will cut from 10 to 200 teeth on a length of 6 inches. The index ring is of large diameter and is solidly locked at each indexing, insuring accuracy and good work. The centers swing a diameter of 8 inches. The cutter head is adjustable to thousandths, and the cutter can be quickly centered by means of a screw collar on the arbor. The slide runs back and comes forward again to the cut at a speed 65 times faster than the cutting feed. This is an important point and reduces the time lost in indexing to a minimum. The travel of the table is regulated by adjustable stops in front, and the machine can be set to work anywhere in the length of the work arbor, avoiding all unnecessary travel. The setting up is done very quickly, so that the machine can be practically used in jobbing work as well as in special manufacturing. They can also be used on small milling cutter work. All parts are accessible and the workmanship throughout first-class.

Price, \$400 00.



Gear Cutting.

Our Gear Cutting Department is equipped with every facility for doing this class of work, which fact enables us to furnish good work at reasonable prices. Among the latest additions to this department is a large rack cutter with automatic feed, built by ourselves to do regular work and take in all varieties of rack cutting, spacing, slotting and dividing, and all that class of work which permits the use of a rotary cutter. The machine has a great range of adjustment, cutting 3 feet at one clamping and dividing to 1-2000 of an inch. Bevel gears are cut upon a special fixture, insuring as correct a tooth as can be shaped by a rotary cutter. Spur and worm gears are cut in the most approved manner. To make this branch complete, we have added during the past year a heavy stock of Brown and Sharpe involute and epicycloidal cutters. Gearing developed and patterns made of wood or metal. We have among our patterns an assortment of bevel and spur gear blanks, and also a variety of cut gears on hand ready for delivery.

Parties sending orders (or if on extensive jobs requiring estimates) by letter will please observe the following list of dimensions which are necessary for us to have:

- The number of teeth or diameter of gear.
- The pitch of gear, either diametral or circular (state which).
- The length of tooth or face of gear.
- The size of hole—length and diameter of hub on either side.
- The center distance of a pair if necessarily exact.
- The material and amount of finish desired.

NOTE.—The word “diameter” means pitch diameter which is of a circle running through the centers of the working depths of the teeth. This measurement we prefer to diameter of gear over all; however, when used, please call it outside diameter.

NOTE.—A spur pinion, to run well, should not have less than 12 teeth nor mitres less than 18 or 20 teeth.

Bevel Gear Cutting on the Universal Milling Machine.

This will be illustrated by a miter gear of 22 teeth and 8 diametral pitch $\frac{3}{4}$ in. face.

Mount the blank gear on an arbor fitting in the spindle of the spiral head, and set the cutter central. Set the spiral head at the proper angle for the bottom of the space as obtained from the drawing. In the example this angle is $41\frac{1}{2}$ degrees.

Set the dividing index for the number of teeth. Ex. 22 teeth require one turn and 54 holes in 66 circle.

Let the cutter just touch the face of the blank at the outside edge. Sink the cutter in the proper depth according to the pitch, as determined from the gear-cutting table. Ex. 8 Pitch depth is .260; raise the knee .260 by index on elevating screw. Start with index pointer in figured row of holes and cut a few teeth. Turn back to the first position and see that the index on the cross slide points to 0. Move the dividing index a few holes to the right and feed the cross slide **in** until the cutter coincides with the inner end of the space. Cut through the same spaces and return to the first one. Turn the index to the left of the figured row as many

holes as it was before turned to the right. Draw the cross slide out as much from O as it was before fed in. Cut through the spaces again. This process must be repeated until the proper number of holes and the proper place for the cross slide is found to make the gauge, Fig. 7, touch at all three points. In the example the cross slide was moved .025 of an inch each side of the center, and the index was set over 18 holes each way. This position having been found, any number of gears like the first one can be cut without setting the cutter central. Begin each new gear with the slide and index in the same position that it was when finishing the last. Having cut through the teeth once, move to the other position as before determined and finish the gear.

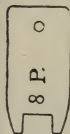
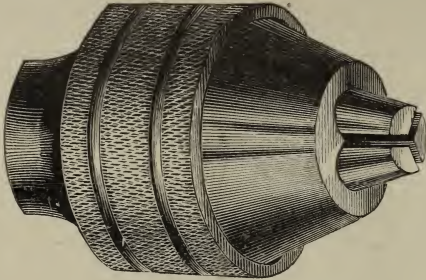


Fig. 7.

PITCH.	Depth to be cut in gear.	Thickness at pitch line.	PITCH.	Depth to be cut in gear.	Thickness at pitch line.
3	.699	.523	14	.149	.112
3½	.598	.448	16	.130	.098
4	.523	.393	18	.115	.087
5	.417	.314	20	.104	.079
6	.347	.262	22	.094	.071
7	.296	.224	24	.087	.065
8	.260	.196	26	.08	.060
9	.231	.175	28	.075	.056
10	.208	.157	30	.071	.052
11	.189	.143	32	.067	.049
12	.174	.131			



The Almond Drill Chuck.

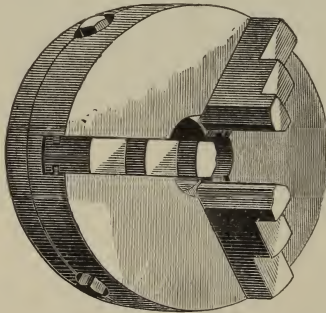
The Almond Drill Chuck has now been in use nine years, and has been received with favor in this and all other countries where drill chucks are used. In this chuck is embodied almost all the features of an ideal tool, which, to be satisfactory should be simple in construction, perfect in action, strong, durable and cheap.

PRICES.

$\frac{3}{16}$ in. diam. \$5 00

$\frac{5}{16}$ in. diam. \$5 00

$\frac{1}{2}$ in. diam. \$8 50



Geared Scroll Chuck.

These Chucks are all made up with three pinions, insuring a perfectly balanced mechanism with a pinion always accessible. The shells for the two smallest sizes are malleable iron, and the pinions and scrolls for all sizes are made of steel. The jaws for all sizes up to and including 5 ins. are steel, all others of the best wrought iron, case hardened,

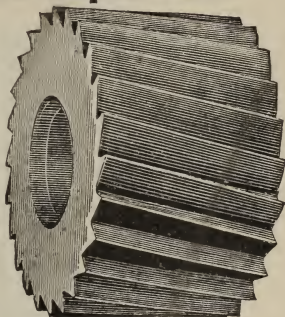
PRICE LIST.

Diam.	Weight.	Diam. of Hole.	Diam. of Face Plate.	Price.
$2\frac{1}{2}$ inches.....	$1\frac{1}{2}$ lbs.....	$\frac{5}{8}$ inches.....	$2\frac{7}{8}$ inches.....	\$ 7 00
3 ".....	$2\frac{1}{2}$ ".....	$\frac{5}{8}$ ".....	3 1-16 ".....	10 00
4 ".....	6 ".....	$\frac{5}{8}$ ".....	$3\frac{3}{4}$ ".....	12 00
5 ".....	10 ".....	$\frac{3}{4}$ ".....	$4\frac{3}{4}$ ".....	14 00
6 ".....	14 ".....	1 1-16 ".....	$5\frac{3}{4}$ ".....	17 00
9 ".....	36 ".....	$2\frac{1}{2}$ ".....	7 ".....	20 00
12 ".....	62 ".....	3 ".....		30 00

Milling Cutters.—Straight or Spiral Teeth.

Our stock of milling cutters includes the regular sizes given below. Straddle mills up to 4 inches diameter with $\frac{3}{8}$ or 1 inch holes, angle cutters 50 to 80 degrees, and right or left hand shank mills.

Orders for special cutters of any form, shape or size can be promptly filled.



Series of Regular Milling Cutters.

A comprehensive selection for general work, including cutters for producing others of any shape and size, and as standard tools serving as models in general design, angle, pitch and shape of tooth, valuable to users of milling machinery who may need information in regard to modern improvements in tools of this class.

SERIES A includes 3 mills, 8 cutters (suitable for key splining), 1 pair of straddle mills, 2 saws, 1 shank cutter, 1 angle cutter.

Price..... \$40 00

SERIES B includes 1 mill, 6 cutters (for key splining), 1 pair straddle mills and 2 saws.

Price..... \$25 00

Price List of Plain Cutters,

WITH 1 INCH STANDARD HOLE.

Width of Face.	Diameter.	Price.	Width of Face.	Diameter.	Price.
1-8	$2\frac{1}{4}$	\$1 30	$\frac{3}{4}$	$2\frac{3}{4}$	\$2 30
3-16	$2\frac{1}{4}$	1 40	1	$2\frac{3}{4}$	2 80
1-4	$2\frac{1}{2}$	1 50	$1\frac{1}{4}$	$2\frac{3}{4}$	3 00
5-16	$2\frac{1}{2}$	1 60	$1\frac{1}{2}$	$2\frac{1}{2}$	3 20
3-8	$2\frac{1}{2}$	1 70	$1\frac{3}{4}$	$2\frac{1}{2}$	3 40
7-16	$2\frac{1}{2}$	1 80	2	$2\frac{1}{2}$	3 70
1-2	$2\frac{3}{4}$	1 90	$2\frac{1}{2}$	$2\frac{1}{2}$	4 10
5-8	$2\frac{3}{4}$	2 10	3	$2\frac{1}{2}$	4 50

Cutters, $1\frac{1}{4}$ in. diameter, with $\frac{5}{8}$ in. hole, $\frac{1}{4}$ less than above prices.

PRICE LIST.

Dia.	Price	Dia.	Price
$\frac{1}{8}$	\$1.00	$\frac{1}{2}$	\$1.60
$\frac{3}{16}$	1.10	$\frac{9}{16}$	1.70
$\frac{1}{4}$	1.20	$\frac{3}{8}$	1.80
$\frac{5}{16}$	1.30	$\frac{11}{16}$	1.90
$\frac{3}{8}$	1.40	$\frac{3}{4}$	2.00
$\frac{7}{16}$	1.50		

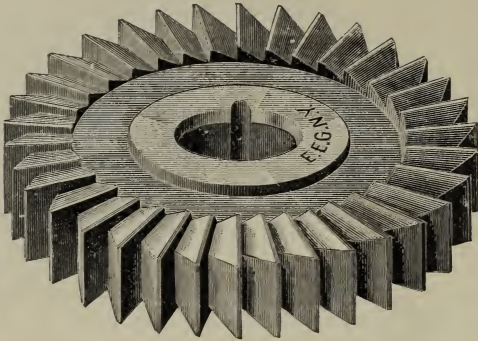
Double Ended Butt Mills.

CUT LEFT HAND.



We are prepared to furnish Butt Mills of the form shown above, in sizes of from $\frac{1}{8}$ to $\frac{3}{4}$ ins. They are made from Stubb's steel rod, and are designed to be held in the spring chuck shown on page 38. We recommend left hand cutters for milling machine work, and right hand cutters for profiler work.

Price List of Straddle Mills.



Diameter.....	$3\frac{1}{2}$	4	5	6
Width of Face.....	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{15}{16}$
Diameter of hole.....	1	1	1	1
Price.....	2.50	3.25	5.50	8.50

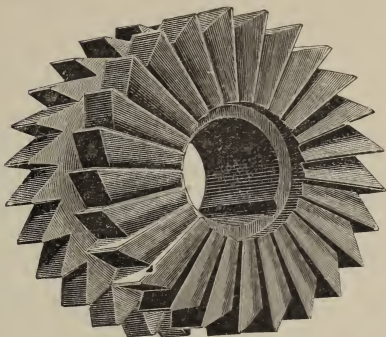
Metal Slitting Saws.

Diameter	Thickness	Diameter of hole	Price
2	1-32	$\frac{5}{8}$	\$.80
2	3-64	$\frac{5}{8}$.80
2	1-16	$\frac{5}{8}$.75
2	3-32	$\frac{5}{8}$.75
$2\frac{1}{2}$	1-32	$\frac{5}{8}$	1.00
$2\frac{1}{2}$	3-64	$\frac{5}{8}$	1.00
$2\frac{1}{2}$	1-16	$\frac{3}{8}$.90
$2\frac{1}{2}$	3-32	$\frac{5}{8}$.90
3	1-32	1	1.25
3	3-64	1	1.10
3	1-16	1	1.00
3	3-32	1	1.00
3	1-8	1	1.00
4	3-64	1	1.45
4	1-16	1	1.25
4	3-32	1	1.20
4	1-8	1	1.20
5	1-16	1	1.80
5	3-32	1	1.60
5	1-8	1	1.60

Butt Mills.

We furnish this style of Butt Mill 3 in. diameter by 2 in. face to fit arbor for any of our Milling Machines. Both faces are cut right hand—and is of economical form.

Price, \$5 00.



We have in stock mills with inserted teeth which are designed for use either as right or left hand cutters. For milling on scale or very hard castings, Mushet steel cutters will be furnished at an additional price of \$1 50,—Mills 6 in., 8 in., and 10 ins., in diameter.

Prices \$6 00, \$7 00 and \$8 00 respectively.

We carry a full stock of annealed cutter forgings of thickness from $\frac{1}{2}$ to 2 ins., and diameters between 4 and 6 inches. These will be furnished to those who wish to work up their own stock at reasonable prices to cover cost of importation.

Bevel Cutters.

Cutters for Spiral Mills.



RIGHT HAND CUTTER.

We furnish these Cutters of 2 in. diameter and $\frac{5}{8}$ of an in. hole, either 50, 60, 70 or 80 degrees angle, right or left hand.

Price \$2 75 each.

Special sizes at special prices,



RIGHT HAND CUTTER.

A Few Remarks on Milling.

In designing the Milling Machinery presented in this Catalogue, we have been guided largely by our own experience in the use of such machines, and the needs of our own manufacturing business have to a great extent governed the variety of sizes and styles that we build. Many of the pieces that were formerly planed are now milled by gang mills with a saving of from 20 to 40% over the planing. In regard to accuracy, much is to be said in favor of the milling. With a properly constructed milling machine, there is but small opportunity for any inaccuracy except such as might occur from the carelessness of the operator. The gang of mills have a certain definite relation to each other, and only by special attention can this relation be changed, while with planer work each cut requires continued careful and accurate measurement and attention. Among the larger pieces formerly planed, but now entirely milled, we would cite the following. Our No. 1 and No. 2 Tapping Machines have all the surface cuts made in the Milling Machines. The Every Day Centers form a very good example of milling. The straight surfaces including the dove-tail on the base and under the tail stock are all milled directly to a fit. The No. 2 and No. 4 Vises are entirely milled ready for the drilling and assembling. All Screw Machine Heads are milled to receive the boxes. All Cap Boxes for screw Machines and Hand Lathes are milled to fit the heads.

The Bench and Post Drill Presses, and the knees of the other drill presses are milled in all surfaces where the planer could be used. As an example of milling on tool steel, we would show the Tool Steel jaws of all our Milling Machine Vises. All keys used in the machines are milled. The Bench Cutter grinder is milled. Ali T slots used on our machinery are milled out of the solid. The smaller ones in both iron and steel are best done with a small mill in the High Speed Attachment. An idea of the speed at which this class of work is performed can be gained from the fact that the usual surface velocity of a mill is 40 feet per minute, and according to the nature of the iron and the shape of the piece from 1 in. to 4 ins. per minute can be milled. Under the most favorable circumstances and on annealed cast iron, Straddle Mills can be run at a surface speed of 65 feet per minute with a feed of about 4 inches, while on other work an end mill 1½ inches in diameter runs 40 turns per minute with about the same feed. Faster speeds and coarser feeds seem to be the tendency in all milling work. The limit to which sizes are milled varies considerably with the nature of the work. The coarser work is milled usually within a limit of .004 of an inch. Some electrical work requires a limit of about .002 of an inch while other pieces are milled at once to the standard, as the fitting required can be much more accurately and cheaply performed by the milling machine than it could be by hand.

To those interested, we will send on application, photographs showing the different cuts taken on the pieces mentioned above; together with the fixtures and mills used for the same.

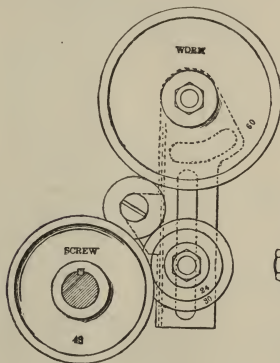


Fig. 2.

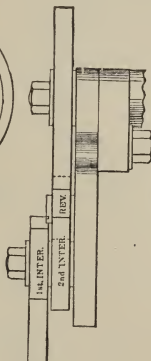


Fig. 3.

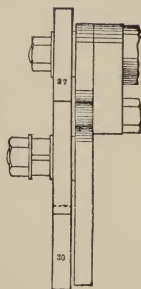


Fig. 4.

Setting the Machine for Spirals.

Two examples will be given, and the method of setting up for right and left-hand spirals, with simple and compound trains of gearing, will be illustrated by them. The first is a left-hand spiral of one turn in 13.33 ins., on a piece 2 ins. in diameter.

In the first part of the **Table of Angles and Gearing for Spirals**, and opposite 13.33, will be found the following gear numbers. Gear on screw 48, first intermediate 24; second intermediate, 30; worm, 60. As this is to be a left-hand spiral the reversing gear goes between the second intermediate and the gear on the worm. The arrangement as it now stands is shown by Figs. 2 and 3. Look at the top of the second part of the table for the diameter of the piece to be milled, and in the column under this diameter and opposite 13.33 will be found the proper angle at which to set the slide. This angle is to be measured to the *left* of 0 for a *left-handed* spiral. Example, in the column under 2 and opposite 13.33 will be found 25 degrees and 10 minutes. This must be measured to the *left* of 0, as the spiral is *left-handed*.

To set for a *right-hand* spiral of 13.33 use the same gears, but with the reversing gear (marked rev. Fig. 3) left out. The angle must now be measured to the *right* of 0.

We will now take an example of a simple geared spiral. One turn in 12 ins. on a 2 in. diameter piece as before. Opposite 12 will be found, gear on screw 30, gear on worm 27. Put these gears in their places and put *any* gear on the stud that will connect them. See Fig. 4. If the spiral is to be left-handed, put the reversing gear between the gear on the stud and the one on the worm.

Improvements in the feed of Nos. 2, 3 and 4 Universal Milling Machines, and Nos. 4½ and 5 Milling Machines.

To accommodate the almost endless variety of work that milling machines are applicable to, we have designed a feed works, giving twelve distinct changes of feed to each spindle speed, which gives a range of $\frac{1}{8}$ of an inch feed each revolution for the coarsest to 1-480 of an inch feed each revolution for the finest.

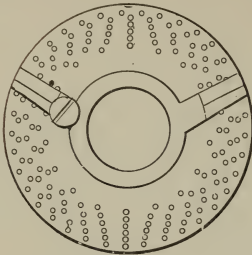


Fig. 5.

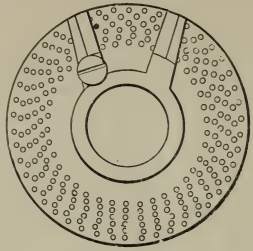


Fig. 6.

Setting Dividing Index.

Two examples will be given: to set sectors to divide 30 and 21.

Ex. 1. 30 divisions require 1 turn and 8 holes in 24 circle. See "*Index Table.*" Set index pin in 24 circle, put one arm of the sector against the pin, and move the other until it takes in 8 holes, *not counting the hole the pin is in.* See Fig. 5.

Ex. 2. 21 divisions require 1 turn and 38 holes in 42 circle. The sectors will not open wide enough to take in 38 holes, so set them to the difference between 42 and 38, or 4 holes, again *omitting to count the hole occupied by the pin.* See Fig. 6. In this last case move the sectors each time in the direction *opposite* to the motion of the index pin.

Taper Gauges.

These gauges are copies of the standards to which all our spindle holes are made. They are valuable in fitting arbors, or special tools to spindles when the machines are in constant use.

Both Plug and Shell gauges are accurately ground.

GAUGE FOR	PRICE.	
	PLUG	SHELL
Nos. 1, 2, 3 Drill Presses	1 25	2 00
Bench Drill, Small Gear Cutter, Cutter Grinder.....	1 25	2 00
Twelve Inch Hand Lathe, No. 4 Drill Press.....	1 50	2 50
Automatic Tapper, Profiler.....	1 50	2 50
No. 0 Universal Milling Machine, No. 1 Miller.....	1 50	2 50
Nos. 1 and 2 Hand Millers, Screw Slotter.....	1 50	2 50
Six Inch Dividing Head.....	1 50	2 50
Fifteen Inch Hand Lathe	1 50	2 50
Nos. 1 and 2 Universal Milling Machine, No. 3 Miller.....	2 25	3 75
No. 3 Hand Miller, No. 4½ Miller.....	2 25	3 75
Ten Inch Dividing Head.....	2 25	3 75
No. 4 Miller, Rack or Screw Feed, or Back Geared.....	2 50	4 00
Lincoln Miller, Lincoln Miller Plain.....	2 50	4 00
Nos. 3 and 4 Universal Milling Machines..	3 00	4 00
No. 5 Miller, Fifteen Inch Dividing Head.....	3 00	4 00

Milling Gear Stud Bracket.

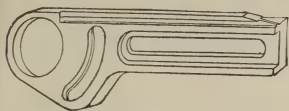


Fig. 8.

The accompanying illustrations show one series of operations which can be performed on the Universal Milling Machine. Fig. 8 will be recognized as the bracket supporting the change gears on the Universal Milling Machine. It is of steel, and is milled all over.

Fig. 9 shows the operation of milling off the flat sides with the overhanging end supported by the center rest.

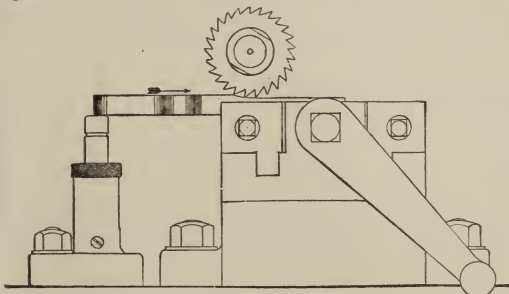


Fig. 9.

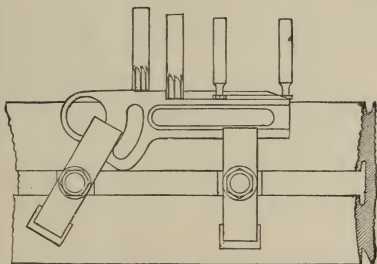


Fig. 10.

Fig. 10 shows the use of small mills in milling the T edge. These are preferably used in the high speed attachment.

Fig. 11 shows the spiral head mounted at right angles to the bed by means of the extension plate, and arranged for milling the outline and the slots in the face of the piece.

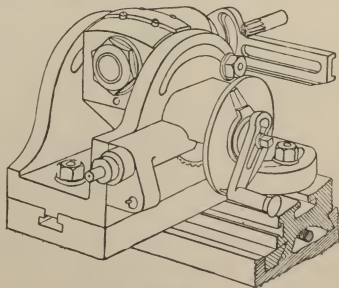


Fig. 11.

Rule for Gearing Up Engine Lathes for Screw Cutting.

Read from the lathe index the number of threads per inch cut by equal gears and multiply it by any number that will give for a product a gear on the index ; put this gear upon the stud, then multiply the number of threads per inch to be cut by the same number and put the resulting gear upon the screw.

EXAMPLE.—To cut $11\frac{1}{2}$ threads per inch. We find on the index that 48 into 48 cuts 6 threads per inch, then

$$\begin{aligned} 6 \times 4 &= 24, \text{ gear on stud,} \\ \text{and } 11\frac{1}{2} \times 4 &= 46, \text{ " " screw.} \end{aligned}$$

Any multiplier may be used so long as the products include gears that belong with the lathe. For instance, instead of 4 as a multiplier we may use 6.

$$\begin{aligned} \text{Thus } 6 \times 6 &= 36, \text{ gear upon stud,} \\ \text{and } 11\frac{1}{2} \times 6 &= 69, \text{ " " screw.} \end{aligned}$$

Calculating Speed of Pulleys.

EXAMPLE.—A main shaft running 110 revs. and a 12 inch hand lathe countershaft with 8 inch tight and loose pulleys running 220 revs. (See page 56.)

TO FIND SIZE OF PULLEY ON MAIN SHAFT:—Multiply diameter of pulley on countershaft by its number of revolutions, and divide the product by number of revolutions of main shaft. The quotient will be its diameter: $8 \times 220 = 1760, 1760 \div 110 = 16$ inches diameter.

TO FIND No. OF REVOLUTIONS OF COUNTERSHAFT:—Multiply diameter of pulley on main shaft by its number of revolutions and divide product by diameter of pulley on countershaft: $16 \times 110 = 1760, 1760 \div 8 = 220$ revs.

TO FIND SIZE OF PULLEY ON COUNTERSHAFT:—Multiply diameter of pulley on main shaft by its number of revolutions, and divide product by number of revolutions of countershaft: $16 \times 110 = 1760, 1760 \div 220 = 8$ inches diameter.

Table of Diametral Pitch, with its Equivalent Circular Pitch Opposite on the Adjoining Column.

Diametral Pitch.	Circular Pitch.	Diametral Pitch.	Circular Pitch.	Circular Pitch.	Diametral Pitch.	Circular Pitch.	Diametral Pitch.
2	1.57	11	.280	1 3-4 in.	1.79	3-4 in.	4.19
2 1-4	1.39	12	.262	1 1-2 "	2.09	11-16 "	4.57
2 1-2	1.25	14	.224	1 7-16 "	2.18	5-8 "	5.03
2 3-4	1.14	16	.196	1 3-8 "	2.28	9-16 "	5.58
3	1.05	18	.174	1 5-16 "	2.39	1-2 "	6.28
3 1-2	.898	20	.157	1 1-4 "	2.51	7-16 "	7.18
4	.785	22	.143	1 3-16 "	2.65	3-8 "	8.38
5	.628	24	.130	1 1-8 "	2.79	5-16 "	10.06
6	.524	26	.120	1 1-16 "	2.96	1-4 "	12.56
7	.448	28	.112	1 "	3.14	3-16 "	16.75
8	.392	30	.104	15-16 "	3.35	1-8 "	25.12
9	.350	32	.098	7-8 "	3.59	1-16 "	50.24
10	.314			13-16 "	3.86		

Simple Rules on Gearing.

The following rules will apply to both Bevel and Spur Gears. When the term "pitch" is used it always signifies diametral (not circular) pitch.

For illustrations we will use gears having 64 teeth and 8 pitch.

TO FIND PITCH DIAMETER:—Divide the number of teeth by the pitch:
 $64 \div 8 = 8$ in. p. diam.

TO FIND No. OF TEETH:—Multiply the pitch diam. by the pitch: 8 in. X
 $8 = 64$, No. of teeth.

TO FIND THE PITCH:—Divide the number of teeth by the pitch diam.
 $64 \div 8$ in. = 8, pitch.

TO FIND OUTSIDE DIAM. OF SPUR WHEELS:—Add 2 to the number of teeth and divide by the pitch: $64 + 2 = 66 \div 8 = 8\frac{1}{4}$ in. O. D.

TO FIND CIRCULAR PITCH:—Divide the decimal 3.1416 the diametrical pitch: $3.1416 \div 8 = .3927$ in.

TO FIND THE DISTANCE BETWEEN THE CENTERS OF TWO SPUR GEARS:—Divide half the sum of the teeth of both gears by the pitch: $64 + 64 = 128 \div 2 = 64 \div 8 = 8$ in. centers.

A simple rule to determine the face of bevel gears is to make them seven times the pitch: 8 pitch bevel will thus be $\frac{7}{8}$ in. face.

Sizes of Standard Hexagon Head Bolts.

Diam. of Bolt.	Th'kn's of Head.	Size of Hexagon	Across Corners	Th'ds per inch	
1-4	1-4	1-2	9-16	20	
5-16	19-64	19-32	11-16	18	
3-8	11-32	11-16	25-32	16	
7-16	25-64	25-32	29-32	14	
1-2	7-16	7-8	1	13	
9-16	31-64	31-32	1	7-64	12
5-8	17-32	1	1	7-32	11
3-4	5-8	1	1	7-16	10
7-8	23-32	1	1	21-32	9
1	13-16	1	1	7-8	8
1 1-8	29-32	1	1	13-16	7
1 1-4	1	2	2	5-16	7
1 3-8	1	2	2	1-2	6
1 1-2	1	2	2	3-4	6
1 5-8	1	2	2	15-16	5 1-2
1 3-4	1	2	3	3-4	5
1 7-8	1	2	3	13-32	5
2	1	3	3	5-8	4 1-2
2 1-4	1	3	4	1-16	4 1-2
2 1-2	1	3	4	1-2	4
2 3-4	2	4	4	29-32	4
3	2	4	5	3-8	3 1-2

Notice that size of hexagon is equal to diameter of bolt + $\frac{1}{2}$ diameter of bolt + $\frac{1}{8}$ of an inch, and also that thickness of head is $\frac{1}{2}$ of hexagon in every case. The thickness of nut is equal to the diameter of bolt.

Miscellaneous Weights.

	Av. Weight Cubic ft.	Av. Weight Cubic in.
Cast Iron.....	450 lbs.	.260 lbs.
Wrought Iron.....	485 "	.281 "
Gun Metal.....	528 "	.306 "
White Pine.....	25 "	.015 "
Steel.....	489 "	.283 "

Cast iron is $17\frac{1}{2}$ times heavier than ordinary kiln dried wood used in common patterns.

Average Cutter Speed and Feed on Soft Cast Iron Surfaces.

The figures are adapted to calculations in milling upon soft cast-iron surfaces, and are subject to change to accompany variations in condition and character of work. In order to figure accurately upon milling work, the speed of cutter and amount of feed per revolution must be observed—that known, the computation is simple, as follows: Multiply the number of revolutions of cutter per minute by the length of feed at one revolution and the product is inches per minute that can be milled. Allowing about 40 ft. per minute for surface speed of cutter, a $\frac{1}{2}$ inch cutter should run at 300 revolutions per minute, with a feed of 1-150 of an inch to a revolution, giving a result of 2 ins. of light milling per minute. An inch cutter would make 150 revolutions per minute, with a feed of 1-100 of an inch on a moderately heavy cut, allowing $1\frac{1}{2}$ inches of milling per minute. A 3 inch cutter would run 50 revolutions per minute, with a feed of 1-50 of an inch on heavy work, giving a result of 1 inch of milling per minute. The above are examples selected from observed results in practical shop usage.

Twist Drill and Steel Wire Gauge.

TABLE OF SIZES OF GAUGE IN DECIMAL PARTS OF AN INCH.

No.	Size of Number in Decimals.	No.	Size of Number in Decimals.	No.	Size of Number in Decimals.	No.	Size of Number in Decimals.
1	.227	16	.175	31	.120	46	.079
2	.219	17	.172	32	.115	47	.077
3	.212	18	.168	33	.112	48	.075
4	.207	19	.164	34	.110	49	.072
5	.204	20	.161	35	.108	50	.069
6	.201	21	.157	36	.106	51	.066
7	.199	22	.155	37	.103	52	.063
8	.197	23	.153	38	.101	53	.058
9	.194	24	.151	39	.099	54	.055
10	.191	25	.148	40	.097	55	.050
11	.188	26	.146	41	.095	56	.045
12	.185	27	.143	42	.092	57	.042
13	.182	28	.139	43	.088	58	.041
14	.180	29	.134	44	.085	59	.040
15	.178	30	.127	45	.081	60	.039

Table of Decimals Equaling Parts of an Inch.

1-64.....	.0156	33-64.....	.5156
1-32.....	.0313	17-32.....	.5313
3-64.....	.0469	35-64.....	.5469
1-16.....	.0625	9-16.....	.5625
5-64.....	.0781	37-64.....	.5781
3-32.....	.0938	19-32.....	.5938
7-64.....	.1094	39-64.....	.6094
1-8.....	.1250	5-8.....	.6250
9-64.....	.1406	41-64.....	.6406
5-32.....	.1563	21-32.....	.6563
11-64.....	.1719	43-64.....	.6719
3-16.....	.1875	11-16.....	.6875
13-64.....	.2031	45-64.....	.7031
7-32.....	.2188	23-32.....	.7188
15-64.....	.2344	47-64.....	.7344
1-4.....	.2500	3-4.....	.7500
17-64.....	.2656	49-64.....	.7656
9-32.....	.2813	25-32.....	.7813
19-64.....	.2969	51-64.....	.7969
5-16.....	.3125	13-16.....	.8125
21-64.....	.3281	53-64.....	.8281
11-32.....	.3438	27-32.....	.8438
23-64.....	.3594	55-64.....	.8594
3-8.....	.3750	7-8.....	.8750
25-64.....	.3906	57-64.....	.8906
13-32.....	.4063	29-32.....	.9063
27-64.....	.4219	59-64.....	.9219
7-16.....	.4375	15-16.....	.9375
29-64.....	.4531	61-64.....	.9531
15-32.....	.4688	31-32.....	.9688
31-64.....	.4844	63-64.....	.9844
1-2.....	.5000	1.....	1.

Table of Wire Gauge Sixes in Decimal Parts of an Inch.

No. of Wire Gauge.	Size of each No. in decimal parts of an inch of the American Wire Gauge.	Size of each No. in decimal parts of an inch of the English Wire Gauge.	No. of Wire Gauge.	Size of each No. in decimal parts of an inch of the American Wire Gauge.	Size of each No. in decimal parts of an inch of the English Wire Gauge.
0000	.460	.454	19	.03539	.042
000	.40964	.425	20	.03196	.035
00	.36480	.380	21	.02846	.032
0	.32495	.340	22	.02535	.028
1	.28930	.300	23	.02257	.025
2	.25763	.284	24	.0201	.022
3	.22942	.259	25	.0179	.020
4	.20431	.238	26	.01594	.018
5	.18194	.220	27	.01419	.016
6	.16202	.203	28	.01264	.014
7	.14428	.180	29	.01126	.013
8	.12849	.165	30	.01002	.012
9	.11443	.148	31	.00893	.010
10	.10189	.134	32	.00795	.009
11	.09074	.120	33	.00708	.008
12	.08081	.109	34	.0063	.007
13	.07196	.095	35	.00561	.005
14	.06408	.083	36	.005	.004
15	.05707	.072	37	.00445	
16	.05082	.065	38	.00396	
17	.04525	.058	39	.00353	
18	.0403	.049	40	.00314	

Weight of Round Steel per Lineal Foot.

For Wrought Iron Multiply Tabular Weights by .993.

Diam. in Inches.	Weight per foot	Diam. in Inches.	Weight per foot	Diam. in Inches.	Weight per foot
1-16	.0104	1 1-16	3.011	2 1-8	12.044
1-8	.042	1 1-8	3.375	2 1-4	13.503
3-16	.094	1 3-16	3.761	2 3-8	15.045
1-4	.167	1 1-4	4.168	2 1-2	16.67
5-16	.261	1 5-16	4.595	2 5-8	18.379
3-8	.375	1 3-8	5.043	2 3-4	20.171
7-16	.511	1 7-16	5.512	2 7-8	22.047
1-2	.667	1 1-2	6.001	3	24.005
9-16	.844	1 9-16	6.512	3 1-8	26.048
5-8	1.042	1 5-8	7.043	3 1-4	28.173
11-16	1.261	1 11-16	7.596	3 3-8	30.332
3-4	1.5	1 3-4	8.169	3 1-2	32.674
13-16	1.761	1 13-16	8.702	3 5-8	35.05
7-8	2.042	1 7-8	9.377	3 3-4	37.508
15-16	2.344	1 15-16	10.013	3 7-8	40.05
1	2.667	2	10.669	4	42.675

Testimonials.

We give below a few of the many testimonials that we have received from parties having both our Universal and Plain Milling Machines in use :

OFFICE OF THE DOMESTIC SEWING MACHINE CO.,

Newark, N. J., July 26th, 1889.

Messrs. E. E. GARVIN & CO.

Dear Sirs:—We take pleasure in expressing the satisfaction we find in the use of machinery of your make. We have a large number of your Millers, Drill Presses and special tools in use, all of which, after from six to fifteen years' service, are giving good satisfaction.

Very truly yours,

THE DOMESTIC MFG. CO.,

Hartford, Conn., Oct. 5th, 1889.

Messrs. E. E. GARVIN & CO.

Dear Sirs:—The two No. 1 Universal Milling Machines that we purchased from you have been kept constantly at work, giving the best of satisfaction. We commend you in sending your machines out as you do, complete with all fixtures. We cannot speak too strongly in favor of these machines, and we cheerfully recommend them to the public.

Yours very truly,

THE INTERNATIONAL GRAPHOPHONE CO.

Lynn, Mass., Oct. 19th, 1889.

Messrs. E. E. GARVIN & CO.

Gentlemen:—Replying to yours of the 8th, I can cheerfully say that we are well satisfied with the Universal Milling Machine furnished us by you. The machine is well adapted to the various kinds of work, and it does all that you claim.

Yours truly,

THOMSON ELECTRIC WELDING CO.,

Jersey City, N. J., Aug. 7th, 1889.

Messrs. E. E. GARVIN & CO.

Gentlemen:—Yours received. We have one of your No. 3 Universal Millers in use, and it is giving us good satisfaction. We find it a very stiff and rangy machine. Adjustments are ample, and the feature of allowing the feed works to be swung in a straight line upon swiveling the table either way, we consider an excellent feature. We take pleasure in recommending your machine to intending purchasers.

Respectfully yours,

RIBON & MARCH.

Hartford, Conn., Oct. 7th, 1889.

Messrs. E. E. GARVIN & CO.

Gentlemen:—Answering your favor of the 4th inst., we would say that the No. 1 Universal Milling Machine purchased of you has proved itself a well-arranged and accurate tool. We notice a number of improvements, also notice that you send it very complete and ready for use.

As soon as we need another machine, shall send you order for same.

Yours truly,

COLT'S PATENT FIREARMS MFG. CO.,

Bridgeport, Conn., Oct. 4th, 1889.

Messrs. E. E. GARVIN & CO.

Gentlemen:—Replying to yours of the 3d, in reference to your No. 1 Universal Milling Machine, we are pleased to say that the two in our works, which we have used for the past sixteen months, have been in every way satisfactory. We have no hesitation in recommending them to users of machines of their type.

Very truly yours,

THE YOST WRITING MACHINE CO.



